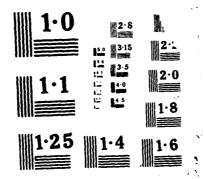
TACTICAL RUBIDIUM FREQUENCY STANDARD (TRFS) VOLUME 2 (U) EG AND G INC SALEM MA T J LYNCH ET AL. OCT 87 RADC-TR-87-166-VOL-2 F19628-83-C-8175 ND-R191 198 1/3 UNCLASSIFIED F/G 14/2



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RADC-TR-87-166, Vol II (of two) Final Technical Report October 1987

TACTICAL RUBIDIUM FREQUENCY STANDARD (TRFS)

EG&G, Inc.

Thomas J. Lynch and William J. Riley

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ROME AIR DEVELOPMENT CENTER
Air Force Systems Command
Griffiss Air Force Base, NY 13441-5700

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18. SUBJECT TERMS (Continued)

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VOLUME II

APPENDICES

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APPENDIX A

TRFS SPECIFICATIONS

SPECIFICATIONS FOR

RUBIDIUM FREQUENCY STANDARD

REVISION E

DRAWING NO. 332819

18 JUNE 1985

SOLID STATE SCIENCES DIVISION ROME AIR DEVELOPMENT CENTER HANSCOM AFB, MA 01731

SHEET 1 OF 36

1. SCOPE.

1.1 SCOPE. THIS SPECIFICATION ESTABLISHES THE REQUIREMENTS FOR PERFORMANCE, DEVELOPMENT AND TEST FOR A RUBIDIUM PREQUENCY STANDARD, HEREINAFTER REFERRED TO AS THE RFS.

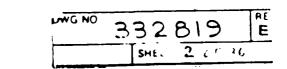
2. APPLICABLE DOCUMENTS.

2.1 GOVERNMENT DOCUMENTS. THE FOLLOWING DOCUMENTS OF THE EXACT ISSUE SHOWN FORM A PART OF THIS SPECIFICATION TO THE EXTENT SPECIFIED HEREIN. IN THE EVENT OF CONFLICT BETWEEN THE DOCUMENTS REFERENCED HEREIN AND THE CONTENTS OF THIS SPECIFICATION, THE CONTENTS OF THIS SPECIFICATION SHALL BE CONSIDERED A SUPERSEDING REQUIREMENT.

2.1.1 SPECIFICATIONS.

MILITARY

MIL-C-3098	REV. F, 28 FEBRUARY 1974.
	CRYSTAL UNIT, QUARTZ, GENERAL
	SPECIFICATION FOR
MIL-B-5087	REV. B, 15 OCTOBER 1964
•	AMENDMENT 2, 31 AUGUST 1970, BONDING,
	ELECTRICAL AND LIGHTNING PROTECTION FOR
	AEROSPACE SYSTEMS.
MIL-E-5400	REV. R, 31 OCTOBER 1975
	ELECTRONIC EQUIPMENT, AIRBORNE, GENERAL
	SPECIFICATION FOR
MIL-S-8516	REV. E, 29 SEPTEMBER 1972
•	SEALING COMPOUND POLYSULFIDE RUBBER
	ELECTRIC CONNECTOR AND ELECTRIC SYSTEMS
	CHEMICALLY CURED.
MIL-S-19500	REV. F, 15 OCTOBER 1977
	SEMICONDUCTOR DEVICES, GENERAL
	SPECIFICATION FOR
MIL-S-23586	REV. C, 2 MARCH 1973
	SEALING COMPOUND ELECTRICAL, SILICONE
	RUBBER ACCELERATOR REQUIRED
MIL-M-38510	REV. D, 31 AUGUST 1977
	SUPPLEMENT 1, 28 PEBRUARY 1978,
	MICROCIRCUITS, GENERAL SPECIFICATION FOR
MIL-H-46855	REV. B, 31 JANUARY 1979
	HUMAN ENGINEERING REQUIREMENTS FOR
	MILITARY SYSTEMS EQUIPMENT AND
•	PACILITIES
MIL-E-4158	REV. E, 11 JANUARY 1973
	ELECTRONIC EQUIPMENT GROUND: GENERAL
•	REQUIREMENTS FOR



MIL-C-38999

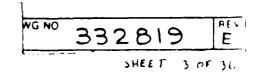
REV. H, 27 PEBRUARY 1981
CONNECTOR, ELECTRICAL, CIRCULAR,
MINIATURE

MIL-C-39012

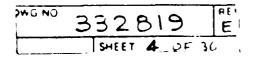
REV. C, 11 AUGUST 1982
CONNECTOR, COAXIAL, RADIO FREQUENCY
REV. B, 28 PEBRUARY 1973
INSULATING COMPOUND, ELECTRICAL
EMBEDDING, REVERSION RESISTANT SILICONE

2.1.2 STANDARDS

MILITARY	
MIL-STD-130	REV. E, 5 AUGUST 1977
	IDENTIFICATION MARKING OF U.S. MILITARY
MIL-STD-143	PROPERTY
WIT-210-143	REV. B, 12 NOVEMBER 1969 STANDARDS AND SPECIFICATIONS, ORDER OF
	PRECEDENCE POR AND SELECTION OF
MIL-STD-210	REV. B, 15 DECEMBER 1973
010 -10	CLIMATIC EXTREMES FOR MILITARY EQUIPMENT
MIL-STD-415	REV. D, 1 OCTOBER 1969
010 110	NOTICE 1, 8 OCTOBER 1971 TEST PROVISIONS
•	POR
	ELECTRONIC SYSTEMS AND ASSOCIATED
	EQUIPMENT, DESIGN CRITERIA POR
MIL-STD-454	REV. F, 15 MARCH 1978
	NOTICE 1, 1 SEPTEMBER 1978, NOTICE 2, 30
	JUNE 1979
	STANDARD GENERAL REQUIREMENTS FOR
	ELECTRICAL
	EQUIPMENT
MIL-STD-461	REV. B, 1 APRIL 1983
	ELECTROMAGNETIC INTERFERENCE
	CHARACTERISTICS,
WTT 000 460	REQUIREMENTS FOR EQUIPMENT
MIL-STD-462	31 JULY 1967, NOTICE 1,
	1 AUGUST 1968, NOTICE 2, 1 MAY 1970 ELECTROMAGNETIC CHARACTERISTICS,
	MEASUREMENT OF
MIL-STD-701	REV. K, 16 MAY 1976
010 .01	LIST OF STANDARD SEMICONDUCTOR DEVICES
MIL-STD-704	REV. A, 9 AUGUST 1966
	NOTICE 1, 7 FEBRUARY 1968, NOTICE 2, 5
	MAY 1970,
·	NOTICE 3, 11 APRIL 1973 PLATFORM
	ELECTRIC POWER
	CHARACTERISTICS



REV. C, 21 OCTOBER 1977 MIL-STD-781 NOTICE 1, 20 MARCH 1981 RELIABILITY DESIGN QUALIFICATION AND PRODUCTION ACCEPTANCE TESTS: **EXPONENTIAL DISTRIBUTION** MIL-STD-785 REV. B, 15 SEPTEMBER 1980 RELIABILITY PROGRAM FOR SYSTEM AND EQUIPMENT, DEVELOPMENT AND PRODUCTION REV. D, 15 DECEMBER 1971 MIL-STD-794 NOTICES 1 THROUGH 4, PARTS AND EQUIPMENT, PROCEDURES FOR PACKAGING AND PACKING OF REV. C, 10 MARCH 1975 MIL-STD-810 ENVIRONMENTAL TEST METHODS REV. A, 28 JUNE 1977 MIL-STD-882 SYSTEM SAFETY REQUIREMENTS MIL-STD-965 15 APRIL 1977 NOTICE 1, 22 DECEMBER 1978, PARTS CONTROL PROGRAM REV. A (AT), 17 SEPTEMBER 1976, MIL-STD-1275 CHARACTERISTICS OF 28 VDC ELECTRICAL SYSTEM IN MILITARY VEHICLES. MIL-STD-1472 REV. B, 31 DECEMBER 1974 NOTICE 1, 10 MAY 1976, NOTICE 2, 10 MAY 1978, HUMAN ENGINEERING DESIGN CRITERIA POR MILITARY SYSTEMS, EQUIPMENT AND **PACILITIES** REV. A, 15 APRIL 1977 MIL-STD-1562 NOTICE 2, 11 JANUARY 1978, LIST OF STANDARD MICROCIRCUITS DOD-STD-100 REV. C, 22 DECEMBER 1978 NOTICE 1, 30 APRIL 1980 NOTICE 2, 28 NOVEMBER 1980 ENGINEERING DRAWING PRACTICES DDD-5000.39 17 JANUARY 1980, ACQUISITION AND MANAGEMENT OF INTEGRATED LOGISTIC SUPPORT FOR SYSTEMS AND EQUIPMENT (COPIES OF SPECIFICATIONS, STANDARDS, DRAWINGS, AND PUBLICATIONS REQUIRED BY SUPPLIERS IN CONNECTION WITH SPECIFIED PROCUREMENT FUNCTIONS SHOULD BE OBTAINED PROM HAZELTINE).



OTHER PUBLICATIONS

HANDBOOKS

AFSC DH I-3 1 JANUARY 1977, HUMAN FACTORS **ENGINEERING** 20 DECEMBER 1978, SYSTEM SAFETY AFSC DH 1-6 MIL-HDBK-157 15 OCTOBER 1979 NOTICE 1, 6 MARCH 1980 TRANSPORTABILITY CRITERIA REV. D, 15 JANUARY 1982, RELIABILITY MIL-HDBK-217 PREDICTIONS OF ELECTRONIC EQUIPMENT REV. H, 1 AUGUST 1978, TECHNICAL MIL-HDBK-300 INFORMATION FILE OF GROUND SUPPORT EQUIPMENT MIL-HDBK-472 24 MAY 1966, MAINTAINABILITY PREDICTIONS

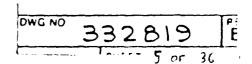
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AERONAUTICAL RADIO, INC.

ARINC REPORT 413 REV. A, DECEMBER 30, 1976
GUIDANCE POR AIRCRAFT AND ELECTRICAL
POWER UTILIZATION AND TRANSIENT
PROTECTION

3. REQUIREMENTS.

- 3.1 ITEM DEFINITION. THE RPS IS AN ATOMIC FREQUENCY STANDARD WHICH UTILIZES AN INTERNAL RUBIDIUM CELL RESONATOR TO CONTROL THE PREQUENCY OP A QUARTZ CRYSTAL OSCILLATOR, WHICH PROVIDES A 10 MHz STABLE REFERENCE FREQUENCY OUTPUT. THE PREQUENCY STANDARD WILL BE USED IN MILITARY GROUND AND AIRBORNE ENVIRONMENTS, AND MUST GENERALLY SATISFY THE REQUIREMENTS OF MILE-4158 AND MIL-E-5400.
- 3.1.1 INTERFACE DEFINITION. THE RPS SHALL PROVIDE A 10 MHz SIGNAL OUTPUT, A BUILT-IN-TEST SIGNAL OUTPUT, AND A CRYSTAL CONTROL SIGNAL OUTPUT. THE INTERFACE SHALL BE ACCOMPLISHED UTILIZING CABLE CONNECTIONS. THE RFS INTERFACE DETAILS ARE PRESENTED IN FIGURE 1 AND THE INTERFACE LEVELS ARE SPECIFIED IN 3.2.1 HEREIN. POWER INPUT TO THE RPS SHALL BE AS SPECIFIED IN 3.2.1.10.



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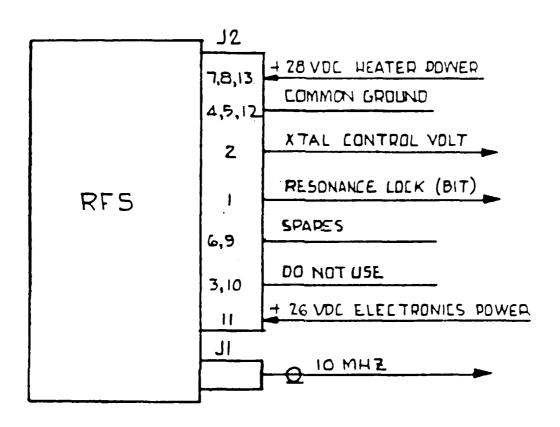
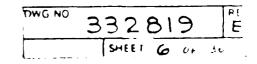


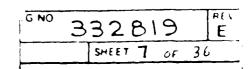
FIGURE 1. RFS INTERFACE DIAGRAM



- 3.1.2 OUTPUT SIGNALS. THE INTERFACE SIGNALS FROM THE RFS SHALL BE AS FOLLOWS:
 - A. THE 10 MHz SIGNAL SHALL BE THE STABLE PREQUENCY REFERENCE.
 - B. THE BUILT-IN-TEST (BIT) SIGNAL SHALL BE PRESENTED TO THE EXTERNAL BIT CIRCUITRY TO MONITOR AS A GO-NO/GO INDICATION OF RFS OPERATION.
 - C. THE CRYSTAL CONTROL SIGNAL SHALL IDENTIFY THE NECESSITY FOR ADJUSTMENT OF THE RFS AS INDICATED BY UPPER AND LOWER LIMITS OF THE DC VOLTAGE.
- 3.2 CHARACTERISTICS. THE RFS CHARACTERISTICS SHALL BE AS SPECIFIED IN THE FOLLOWING PARAGRAPHS.
 - 3.2.1 PERFORMANCE.

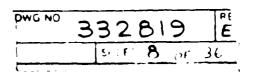
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- 3.2.1.1 OUTPUT. THE RFS OUTPUTS SHALL BE AS FOLLOWS:
 - A. 10 MHz REFERENCE. THE 10 MHz REFERENCE OUTPUT SHALL BE A 10 MHz SINEWAVE, 0.5 VRMS (+30%, -10%) INTO A 50 OHM ±10% RESISTIVE LOAD. THE OUTPUT IMPEDANCE SHALL BE 50 OHMS ±10%
 - B. BUILT-IN-TEST (BIT). .THE BIT OUTPUT SHALL BE CAPABLE OF SINKING 20 ma WITH A VOLTAGE DROP OF LESS THAN 1 VOLT TO INDICATE A GO CONDITION AND SHALL HAVE A LEAKAGE CURRENT OF LESS THAN 100 UA AT 30 VDC TO INDICATE A NO-GO CONDITION.
 - C. CRYSTAL CONTROL VOLTAGE. THE CRYSTAL CONTROL VOLTAGE SHALL BE A SIGNAL THAT IDENTIFIES THE NECESSITY FOR RECALIBRATION OF THE RFS AS INDICATED BY A DC VOLTAGE OF LESS THAN +3.0 VOLTS OR GREATER THAN +12.0 VOLTS. THIS VOLTAGE SHALL BE 7.5 \$2 VDC AT SHIPMENT.
- 3.2.1.2 PREQUENCY ACCURACY AT SHIPMENT. ONE HOUR AFTER TURN ON, THE PRACTIONAL ERROR OF THE RFS AT TIME OF SHIPMENT SHALL BE LESS THAN 5 PARTS IN 10¹¹.
- 3.2.1.3 PREQUENCY ADJUSTMENT. THE FREQUENCY OF THE RFS SHALL BE ADJUSTABLE TO WITHIN 2 PARTS IN 10¹¹ OVER THE RANGE OF 3 PARTS IN 10⁹.



3.2.1.4 STABILITY.

- 3.2.1.4.1 LONG TERM STABILITY. THE LONG TERM DRIFT OVER ANY COMBINATION OF ENVIRONMENTAL CONDITIONS SHALL BE LESS THAN 5 PARTS IN $10^{10}/\text{year}$.
- 3.2.1.4.2 SHORT TERM STABILITY. THE SQUARE ROOT OF THE ALLAN VARIANCE σ γ (γ) OF THE FRACTIONAL PREQUENCY OFFSET Y FROM NOMINAL FOR SAMPLING INTERVALS γ BETWEEN 1 AND 100 SECONDS SHALL BE LESS THAN (4 X 10 $^{-1}$) UNDER QUIESCENT CONDITIONS.
- 3.2.1.5 PREQUENCY RETRACE. THE RETRACE ERROR AT A CONSTANT TEMPERATURE SHALL BE LESS THAN 5 PARTS IN 10¹¹ WHEN THE DURATION OF THE POWER-OPF STATE HAS BEEN LESS THAN 24 HOURS. THE RETRACE ERROR SHALL NOT BE CUMULATIVE FOR MULTIPLE CYCLES.
- 3.2.1.6 PREQUENCY VARIATION WITH VOLTAGE. OUTPUT PREQUENCY VARIATIONS SHALL BE LESS THAN I PART IN 10¹² FOR AN INPUT VOLTAGE OF +26 VOLTS VARIED BY ±10% AND SHALL BE LESS THAN 5 PARTS IN 10¹¹ FOR THE VOLTAGE RANGE SPECIFIED IN 3.2.1.10. THE OUTPUT PREQUENCY VARIATION SHALL BE LESS THAN 1 PART IN 10⁸ FOR HEATER VOLTAGE DROPOUT OF 10 SECONDS MAXIMUM DURATION.
- 3.2.1.7 SIGNAL TO NOISE (SSB 1 Hz BW). THE OUTPUT SIGNAL-TO-NOISE RATIO SHALL BE GREATER THAN 80 dB AT 100 Hz FROM THE CARRIER, GREATER THAN 95 dB AT 1kHz FROM THE CARRIER, AND GREATER THAN 60 dB AT 1 Hz FROM THE CARRIER OVER ANY COMBINATION OF ENVIRONMENTAL CONDITIONS SPECIFIED HEREIN.
- 3.2.1.8 HARMONIC/NON-HARMONIC COMPONENTS. HARMONIC DISTORTION COMPONENTS SHALL BE 30 dB BELOW THE CARRIER LEVEL. NON-HARMONIC DISTORTION COMPONENTS SHALL BE 60 dB OR MORE DOWN ALL THE WAY INTO THE CARRIER. THE DISTORTION REQUIREMENTS SHALL BE MET OVER ANY COMBINATION OF ENVIRONMENTAL CONDITIONS SPECIFIED HEREIN.
- 3.2.1.9 MAGNETIC PIELD. PRACTIONAL PREQUENCY ERROR DUE TO MAGNETIC FIELD EFFECTS SHALL BE LESS THAN 2 PARTS IN 1011 PER GUASS (WORST CASE ORIENTATION).
- 3.2.1.10 INPUT VOLTAGE. TWO INPUT VOLTAGE LINES SHALL BE PROVIDED WITH A SINGLE GROUND RETURN.
 - A. THE RFS HEATER CIRCUIT INPUT SHALL BE +28 VDC IN ACCORDANCE WITH THE REQUIREMENTS SPECIFIED IN MIL-STD-704, CATEGORY B, MIL-STD-1275, AND 3.3.2.1 OF THIS SPECIFICATION.



- B. THE RFS ELECTRONIC CIRCUITS INPUT WILL BE +26 VDC AND IN ACCORDANCE WITH THE REQUIREMENTS SPECIFIED IN MIL-STD-704, CATEGORY B AND MIL-STD-1275 EXCEPT FOR:
 - O VOLTAGE RANGE INCLUDING RIPPLE COMPONENTS: 26 ±4 V AT 400 mA MAX
 - TRANSIENTS: 50 V MAX WITH RESPECT TO GROUND FOR 1 SEC MAX.
- 3.2.1.11 POWER CONSUMPTION. THE TOTAL RFS POWER CONSUMPTION INCLUDING ELECTRONICS AND HEATER POWER SHALL NOT EXCEED THE FOLLOWING:

	25°C	-55°C
STEADY STATE MAXIMUM FOR HEATERS AND ELECTRONICS	17 W	23 W
PEAK DURING WARM-UP FOR HEATERS AND ELECTRONICS	110 W*	110 W*

*FOR 2 MINUTES MAXIMUM

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- 3.2.1.2 WARM-UP. FOR ANY COMBINATION OF ENVIRONMENTAL CONDITIONS AND THE VOLTAGE RANGE AS SPECIFIED IN 3.2.1.10, THE RFS SHALL REQUIRE NO LONGER THAN POUR MINUTES TO ACHIEVE A FREQUENCY ACCURACY OF 5 x 10^{-10} . At an ambient temperature of 25°C, the RFS SHALL REQUIRE NO LONGER THAN 1.5 MINUTES TO LOCK, 2.0 MIN TO 1 PART IN 10^9 and 2.5 MIN TO 5 PARTS IN 10^{10} .
- 3.2.1.13 PREQUENCY VARIATION WITH OPERATING TEMPERATURES. PREQUENCY VARIATIONS WITH TEMPERATURE SHALL BE LESS THAN 3 PARTS IN 10 OVER THE TEMPERATURE RANGE SPECIFIED IN 3.2.5.1.1.
- 3.2.1.14 FREQUENCY VARIATION WITH PRESSURE. PREQUENCY VARIATION WITH PRESSURE SHALL BE LESS THAN I X 10-13 M BAR.
- 3.2.1.15 SHORT-CIRCUIT PROTECTION. ALL OUTPUTS SHALL BE PROTECTED FROM DAMAGE DUE TO SHORT CIRCUITS AT ANY OF THE TERMINALS. THERE SHALL BE NO DEGRADATION BELOW THE SPECIFIED PERFORMANCE LIMITS HEREIN OF THE 10 MHz OUTPUT BY SHORT CIRCUIT OF ANY OTHER OUTPUT OR COMBINATION OF OUTPUTS.
- 3.2.2 PHYSICAL CHARACTERISTICS. THE RFS PHYSICAL CHARACTERISTICS SHALL BE AS SPECIFIED IN THE POLLOWING PARAGRAPHS AND AS SHOWN IN FIGURE 2.



3.2.2.1 DIMENSIONAL AND VOLUMETRIC LIMITATIONS. THE RFS SHALL NOT EXCEED THE FOLLOWING DIMENSIONAL PARAMETERS WITH ADDITIONAL SPACE (K PACTOR) FOR CONNECTORS, HANDLES, ETC.:

SIZE (IN)

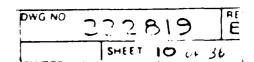
K FACTOR TOTAL LENGTH (IN)

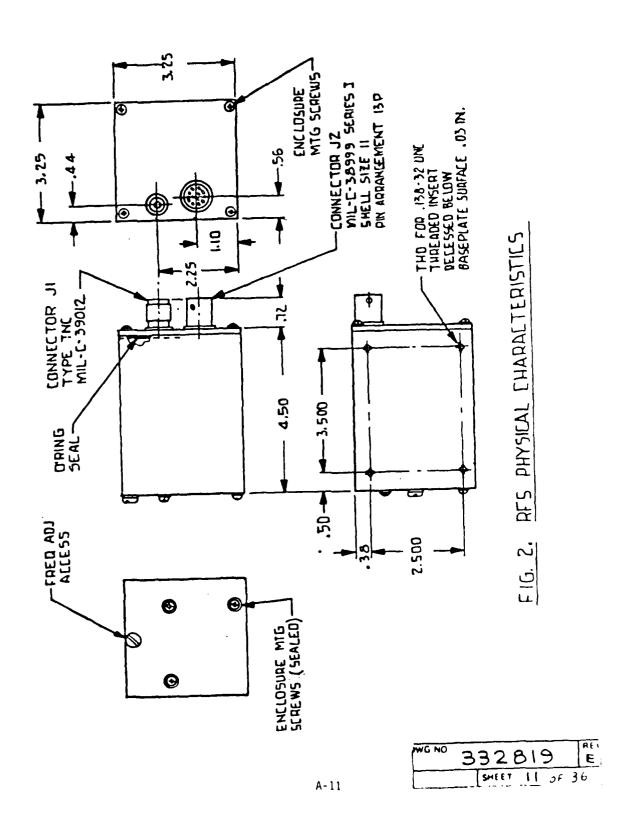
- 3.25 H X 3.25 W X 4.5L
- 0.97 (0.72 PRONT, 0.25 REAR)
- 3.2.2.2 WEIGHT. THE WEIGHT OF THE RFS SHALL NOT EXCEED 3.0 POUNDS.
- 3.2.2.3 PRONT PANEL REQUIREMENTS. THE FRONT PANEL SHALL INCLUDE THE FOLLOWING:
 - A. CONNECTOR PER MIL-C-38999 SERIES I, SHELL SIZE 11, AND INSERT ARRANGEMENT 35.
 - B. COAXIAL CONNECTOR TYPE "TNC" IN ACCORDANCE WITH MIL-C-39012. THE CONNECTOR FLANGE SHALL BE GROUNDED.
 - 3.2.2.4 OTHER REQUIREMENTS.
 - A. MANUFACTURER MARKING SHALL BE AFFIXED TO THE EXTERIOR PRONT OF THE RFS.
 - B. FREQUENCY ADJUSTMENT CONTROL SHALL BE ACCESSIBLE FROM THE BACK OF THE RFS.
 - C. MOUNTING HOLES FOR SCREWS SHALL BE PROVIDED AS SHOWN IN FIGURE 2. THESE SHALL BE BLIND HOLES, SEALED INTERNALLY.
- 3.2.2.5 ORIENTATION. THE RFS SHALL MEET ALL PERFORMANCE REQUIREMENTS REGARDLESS OF ORIENTATION.
- 3.2.3 RELIABILITY. THE RFS SHALL HAVE THE FOLLOWING MINIMUM RELIABILITY VALUES:

ENVIRONMENT	DESIGN MTBF (HRS)	TEST MTBF	
AIRBORNE UNINHABITED FIGHTER	12975	5310	
GROUND FIXED	34408	14027	
GROUND MOBILE	21352	8754	

THE DESIGN MTBF IS THE VALUE WHICH THE RELIABILITY PREDICTIONS MUST ACHIEVE AND SHALL BE CONSIDERED THE SAME AS THE SERIES MTBF.

3.2.3.1 USEFUL LIFE. THE RFS SHALL HAVE A USEFUL LIFETIME OF 25 YEARS.





3.2.3.2 DESIGN PRACTICES.

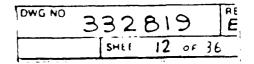
- 3.2.3.2.1 RELIABILITY DESIGN REQUIREMENTS. THE RFS SHALL BE DESIGNED SUCH THAT A FAILURE SHALL NOT RESULT IN THE FAILURE OF ANY INTERFACING ITEM. FURTHER, THE RFS DESIGN SHALL NOT DEGRADE THE PERFORMANCE OF ANY INTERFACING ITEM.
- 3.2.3.2.2 RELIABILITY PREDICTIONS. RELIABILITY PREDICTIONS FOR THE RFS SHALL BE DONE IN ACCORDANCE WITH THE DETAILED PARTS STRESS PROCEDURE OF MIL-HDBK-217, USING THE ENVIRONMENTS LISTED IN 3.2.3 HEREIN. PART AMBIENT TEMPERATURES USED FOR THE RELIABILITY PREDICTIONS SHALL BE THOSE OBTAINED WHEN THE RFS IS MOUNTED TO THE HEAT SINK DESCRIBED IN 3.2.5.1.1 UNDER THE FOLLOWING COOLING AIR CONDITIONS:

ENVIRONMENT	COOLING AIR TEMPERATURE	FLOW RATE
AIRBORNE UNINHABITED FIGHTER GROUND PIXED	2 °C 30°C	0.15 LB/MIN 1.9 LB/MIN
GROUND MOBILE	40°C	1.9 LB/MIN

3.2.4 MAINTAINABILITY. THE RFS SHALL BE DESIGNED TO ACHIEVE THE MAINTENANCE TIME REQUIREMENTS SPECIFIED HEREIN. THE REQUIREMENTS ARE BASED ON THE UTILIZATION OP SUITABLY TRAINED MAINTENANCE PERSONNEL OF THE PROPER SKILL LEVEL.

3.2.4.1 QUANTITATIVE MAINTENANCE VALUES.

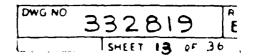
- 3.2.4.1.1 SELF-TEST. THE RFS SHALL CONTAIN SELF-TEST PROVISIONS WHICH CONTINUOUSLY MONITOR RFS OPERATION. FAULT DETECTION PROVIDED BY BUILT-IN TEST (BIT) SHALL DETECT 98.6% OF ALL RFS FAILURES, BASED ON PROBABILITY OF OCCURRENCE. UPON THE OCCURRENCE OF A FAULT, THE RFS SHALL SET THE BIT SIGNAL TO THE NO-GO INDICATION.
- 3.2.4.1.2 CORRECTIVE MAINTENANCE. THE RFS SHALL BE CAPABLE OF BEING MAINTAINED WITHIN THE FOLLOWING TIME CONSTRAINTS:
 - A. MEAN CORRECTIVE MAINTENANCE TIME (\mathbf{H}_{CT}) OF NOT MORE THAN 4.0 HOURS.
 - B. MAXIMUM CORRECTIVE MAINTENANCE TIME (MMAXCT) OF NOT MORE THAN 10 HOURS AT THE 95TH PERCENTILE.



- 3.2.4.1.3 PREVENTIVE MAINTENANCE. THE POLLOWING CONDITIONS ARE INDICATIONS OF THE NEED FOR REPLACEMENT OR ADJUSTMENT. A CRYSTAL VOLTAGE OUTSIDE THE RANGE SPECIFIED IN 3.2.1.1C INDICATES THE NECESSITY FOR ADJUSTMENT TO THE LEVEL SPECIFIED IN PARAGRAPH 3.2.1.1A. INABILITY TO SO ADJUST IS AN INDICATION OF APPROACHING CRYSTAL END OF LIFE. THIS ADJUSTMENT SHALL NOT BE REQUIRED MORE PREQUENTLY THAN ONCE EVERY 10,000 HOURS OF OPERATION.
- 3.2.5 ENVIRONMENTAL CONDITIONS. THE RFS SHALL MEET ALL THE PERFORMANCE REQUIREMENTS SPECIFIED HEREIN WHEN SUBJECTED TO ANY INDIVIDUAL OR PROBABLE COMBINATION OF SERVICE OR INDUCED ENVIRONMENTAL CONDITIONS AS DEFINED IN MIL-E-5400 CLASS I AND MIL-E-4158, EXCEPT AS SPECIFIED HEREIN. NO ELECTRICAL OR MECHANICAL DAMAGE, OR PERFORMANCE DEGRADATION SHALL OCCUR DURING OPERATION OR AFTER STORAGE UNDER THE CONDITIONS SPECIFIED HEREIN.

3.2.5.1 TEMPERATURE.

- 3.2.5.1.1 OPERATING TEMPERATURE. THE RFS SHALL MEET THE PERFORMANCE REQUIREMENTS SPECIFIED HEREIN WHEN SUBJECTED TO EXTENDED EXPOSURE TO AMBIENT TEMPERATURE PROM -55°C TO +71°C DURING CONTINUOUS OPERATION. THE RPS SHALL MEET THESE REQUIREMENTS WHEN MOUNTED TO A HEAT SINK WHICH IS PORCED CONVECTION COOLED. THE HEAT SINK SIZE WILL NOT BE LARGER THAN THE RFS DIMENSIONS IN WIDTH AND DEPTH AND WILL BE LIMITED TO A 1.0 INCH HEIGHT. THE HEAT SINK THERMAL RESISTANCE WILL BE 0.45°C/W FROM AMBIENT AIR TO THE MOUNTING SURFACE OF THE HEAT SINK. THE HEAT SINK MOUNTING SURFACE WILL HAVE A SURPACE PINISH OF 32 UIN AND A FLATNESS OF 0.003 IN TIR.
- 3.2.5.1.2 STORAGE TEMPERATURE (NON-OPERATING). THE RFS SHALL WITHSTAND WITHOUT DAMAGE AMBIENT TEMPERATURES FROM -62°C TO +95°C WHILE NON-OPERATING.
- 3.2.5.1.3 TRANSIENT TEMPERATURE. THE RFS SHALL WITHSTAND VARIATION IN AIR TEMPERATURE AS HIGH AS 2°C PER MINUTE WITHIN THE TEMPERATURE RANGES DEFINED IN 3.2.5.1.1. AND 3.2.5.1.2.
- 3.2.5.1.4 TEMPERATURE SHOCK. THE RFS, WHILE NON-OPERATING, SHALL WITHSTAND SUDDEN CHANGES IN TEMPERATURE WITHIN THE TEMPERATURE RANGE OF -57°C TO +71°C
- 3.2.5.1.5 TEMPERATURE ALTITUDE. THE RFS SHALL MEET THE PERFORMANCE REQUIREMENTS SPECIFIED HEREIN WHEN SUBJECTED TO TEMPERATURES IN ACCORDANCE WITH 3.2.5.1.1 AND ALTITUDES FROM SEA LEVEL TO 70,000 PEET.



3.2.5.2 SHOCK.

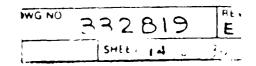
3.2.5.2.1 BENCH HANDLING SHOCK. THE RFS SHALL WITHSTAND THE SHOCK ENCOUNTERED DURING SERVICING. THE EQUIPMENT SHALL WITHSTAND THIS SHOCK REMOVED FROM ITS NORMAL ENCLOSURE AS IT WOULD APPEAR ON THE REPAIR BENCH.

- 3.2.5.2.2 OPERATION SHOCK. THE RFS SHALL OPERATE WITHIN SPECIFIED PERFORMANCE REQUIREMENTS WHEN BEING SUBJECTED TO 18 IMPACT SHOCKS, CONSISTING OF 6 SHOCKS (3 IN EACH OPPOSITE DIRECTION) ALONG EACH OF THREE ORTHOGONAL AXES. THE WAVEFORM AND AMPLITUDE OP SHOCK PULSES SHALL BE HALF SINE WAVE 20G PEAK, 11 MILLISECONDS NOMINAL DURATION.
- 3.2.5.2.3 ACCELERATION. PREQUENCY ERROR SHALL BE LESS THAN
 4 X 10⁻¹ WHEN SUBJECTED TO ACCELERATION PORCES OF MAGNITUDES AND
 DIRECTIONS SPECIFIED IN THE FOLLOWING TABLE:

ACCELERATION PORCES

DIRECTION	LEVEL (G)	
PERPENDICULAR TO BASE OF EQUIPMENT DOWNWARD UPWARD	10 10	
PERPENDICULAR TO SIDE OF EQUIPMENT LATERAL (RIGHT AND LEFT)	10	
PERPENDICULAR TO FRONT OF EQUIPMENT FOR AND AFT	10	

- 3.2.5.3 VIBRATION. THE RPS SHALL MEET THE POLLOWING REQUIREMENTS WHEN HARD MOUNTED.
- 3.2.5.3.1 RANDOM VIBRATION. THIS VIBRATION REQUIREMENT SHALL BE VERIFIED IN ACCORDANCE WITH THE GENERAL REQUIREMENTS OF MIL-STD-810, METHOD 514.2. TEST TIMES SHALL BE 0.5 HOUR PER AXIS POR THE PERFORMANCE LEVELS AND 2.0 HOURS FPER AXIS FOR THE ENDURANCE LEVELS.
- 3.2.5.3.1.1 PERFORMANCE LEVEL. THE FREQUENCY ERROR SHALL BE LESS THAN 5 X 10¹⁰ WHEN MEASURED ON A CLOCK OVER A ONE HALF (1/2) HOUR INTERVAL AT THE POLLOWING PERFORMANCE VIBRATION LEVELS:



PERFORMANCE LEVEL	FOR	VERTICAL AXIS
15 - 20 H,	-	.086 g2/H2
20 - 30 HŽ	-	.332 g ² /Hz
30 - 40 Hz	-	.564 g ² /Hz
40 - 50 Hz	-	.226 g ² /Hz
50 - 60 Hz	-	$.037 g^2/Hz$
60 - 70 Hz	-	$.0123 g^{2}/Hz$
70 - 300 Hz	-	$.01 g^2/Hz$
300- 2000 Hz	-	.005 g ² /Hz

NOTE: IF UNABLE TO TEST WITH .005 G^2/Hz , THEN TEST WITH .01 G^2/Hz .

PERFO	RMANC	E LEVEL	POR	HORIZONTAL AXIS
15 -	20	Hz	_	.223 g ² /Hz
20 -	30	Hz	-	$.462 a^2/Hz$
30 -	40	Hz	-	.138 q^2/Hz
40 -	50	Hz	-	.133 g^2/Hz
50 -	60	Hz	-	.170 q^2/Hz
60 -	70	Hz	-	.175 a^2/Hz
70 -	. 80	Hz	-	.136 q^2/Hz
80 -	` 90	H2	-	$.089 q^2/Hz$
90 -	100	Hz	-	$.059 g^2/Hz$
100 -	110	Hz	-	$.041 g^2/Hz$
110 -	120	Hz	-	$030 q^2/Hz$
120 -	130	Hz	-	$023 g^2/Hz$
130 -	140	Hz	-	$.019 q^2/Hz$
140 -	150	Hz	-	$.016 g^2/Hz$
150 -	160	Hz	-	$.014 g^2/Hz$
160 -	170	Hz	-	$.012 g^2/Hz$
170 -	180	Hz	-	.011 g_2^2/Hz
180 -	300	Hz	-	.01 g^2/Hz
300 ~	2000	Hz	-	$.005 g^2/Hz$

3.2.5.3.1.2 ENDURANCE LEVEL. THE RFS SHALL MEET ALL PERFORMANCE REQUIREMENTS OF THIS SPECIFICATION AFTER VIBRATION AT THE POLLOWING ENDURANCE LEVELS.

ENDURANCE LEVEL		POR	VERTICAL AXIS		
15 -	20	Hz	•	$.0857 g^2/Hz$	
20 ~	30		-	.332 q^{2}/Hz	
30 -	40	Hz	-	.564 g ² /Hz	
40 -	50	Hz	-	.226 g ² /Hz	
50 -	60	Hz	-	$.037 g^2/Hz$	
60 -	70	Ηz	<u> </u>	.013 q^2/Hz	
70 -	2000	Hz	-	$.01 g^2/Hz$	

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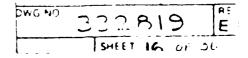
ENDURANCE LEVEL	POR	HORIZONTAL AXIS
15 - 20 Hz	-	.223 g ² /Hz
20 - 30 HZ	-	.465 g ² /Hz
30 - 40 HZ	-	.137 g^2/Hz
40 - 50 HZ	-	$.088 g^2/Hz$
50 - 60 HZ	-	.133 g^2/Hz
60 - 70 HZ	-	.185 g^2/Hz
70 - 80 HZ	_	.171 g^2/Hz
80 - 90 HZ	-	.119 g^2/Hz
90 - 100 HZ	-	$0.78 \text{ g}^{2}/\text{Hz}$
100 - 110 HZ	-	$.054 \text{ g}^2/\text{Hz}$
110 - 120 HZ	-	$040 \text{ g}^2/\text{Hz}$
120 - 130 HZ	-	$.032 \text{ g}^2/\text{Hz}$
130 - 140 HZ	-	$.026 \text{ g}^2/\text{Hz}$
140 - 150 HZ	-	$.022 g^2/Hz$
150 - 160 HZ	_	$.019 g^2/Hz$
160 - 170 HZ	-	.016 g ² /Hz
170 - 180 Hz	-	$.014 g^2/Hz$
180 - 190 Hz	_	.013 g ² /Hz
190 - 200 Hz	-	.012 g ² /Hz
200 - 2000 Hz	_	2 2 / 11 -
200 2000 nZ	_	.UI g-/Hz

3.2.5.3.2 SINUSOIDAL VIBRATION. THE PREQUENCY ERROR SHALL BE LESS THAN 1 X 10^{-9} MEASURED WITH T = 1 SECOND BELOW 20 HZ AND T = 0.1 SECOND ABOVE 20 HZ, AT THE POLLOWING SINUSOIDAL VIBRATION LEVELS:

A. MINIMUM SINUSOID VIBRATION.

THIS VIBRATION REQUIREMENT SHALL BE VERIFIED IN ACCORDANCE WITH MIL-STD-810, METHOD 514.2, PROCEDURE VIII, CURVE V. CYCLING SHALL BE 5.5 HOURS PER AXIS.

PERFORMANCE LEVEL	POR	HORIZONTAL AND VERTICAL AXIS
5.0 - 5.5 Hz	-	1.0 INCH DOUBLE
5.5 - 200 Hz	_	AMPLITUDE ± 1.5 g PEAK

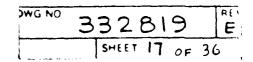


B. MAXIMUM SINUSOIDAL VIBRATION.

CONTRACT CONTRACTOR CONTRACTOR CONTRACTOR

THIS VIBRATION REQUIREMENT SHALL BE VERIFIED IN ACCORDANCE WITH THE GENERAL REQUIREMENTS OF MILSTD-810, METHOD 514.2. CYCLING SHALL BE 60 MINUTES PER AXIS AND RESONANT DWELL SHALL BE 10 MINUTES AT EACH OF THE POLLOWING POINTS:

VERTICAL	LAXIS			HORIZONTAL AXIS
35 Hz 52 Hz 70 Hz 105 Hz				25 Hz 35 Hz 50 Hz 62 Hz
PERFORM	ANCE LE	VE L	FOR	VERTICAL AXIS
5 - 10 - 20 - 22.5 - 25 - 27.5 - 30 - 32.5 - 37.5 - 40 - 42.5 -	10 20 22.5 25 27.5 30 32.5 37.5 40 42.5	Hz Hz Hz Hz Hz Hz Hz	- - - - - - - - -	1 g PEAK 1.5 g PEAK 2.5 g PEAK 3.75 g PEAK 5.5 g PEAK 8.0 g PEAK 11.5 g PEAK 11.5 g PEAK 14.25 g PEAK 13.5 g PEAK 12 g PEAK 9 g PEAK
45 - 47.5 - 50 - 52.5 - 60 - 65 - 70 - 80 - 90 - 100 - 150 - 500	47.5 50 52.5 55 60 65 70 80 90 100 150	HZ HZ HZ HZ HZ HZ HZ HZ HZ	-	7 g PEAK 5.5 g PEAK 4.75 g PEAK 4.0 g PEAK 3.5 g PEAK 2.75 g PEAK 2.25 g PEAK 2.0 g PEAK 1.0 g PEAK 1.0 g PEAK 1.0 g PEAK 1.0 g PEAK
500 -	2000	Ηz	-	.25 g PEAK

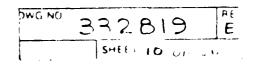


PERFOR	MA!	NCE LEVI	EL	FOR	HOR	ZONTAL AXIS
5	_	10	Hz	-	1	g PEAK
10	-	20	Hz	-	2.5	g PEAK
20	-	22.5	Ηz	•	5	g PEAF
22.5	_	25	Нz	-	6.5	Q PEAK
25	-	27.5	Ηz	-	6.5	g PEAK
27.5	-	30	Hz	-	6.0	g PEAK
30	-	35	Ηz	-	5.0	g PEAK
35	-	37.5	Ηz	-	6.0	g PEAK
37.5	_	40	Ηz	-	7.5	Q PEAK
40	-	45	Ηz	-	8.25	g PEAK
45	-	50	Hz	-	9.0	g PEAK
50	_	55	Ηz	-	10.0	g PEAK
55	-	60	H Z	-	10.5	g PEAK
60	-	65	Ηz	-	10.5	g PEAK
65	-	70	Ηz	-	10.5	g PEAK
70	-	75	Ηz	-	9.5	g PEAK
75	-	80	Ηz	-	8.0	g PEAK
80	_	85	Ηz	-	7.0	g PEAK
85	-	90	Яz	-	6.0	g PEAK
90	-	95	Ηz	-	5.5	g PEAK
95	-	100	Ηz	-	4.5	g PEAK
100	_	125	Ηz	-	4.0	g PEAK
125	-	150	Ηz	-	2.5	g PEAK
150	-	400	Нz	-	2.0	g PEAK
400	-	1000	Ηz	-	1.0	g PEAK
1000	-	2000	Ηz	-	. 5	g PEAR

- 3.2.5.4 ACOUSTIC NOISE. THE RFS SHALL MEET THE PERFORMANCE REQUIREMENTS SPECIFIED HEREIN WHEN SUBJECTED TO THE ACOUSTIC NOISE TEST CONDITIONS SPECIFIED IN MIL-STD-810, METHOD 512.2
- 3.2.5.5 HUMIDITY. THE RPS SHALL MEET THE PERFORMANCE REQUIREMENTS SPECIFIED HEREIN OVER THE FOLLOWING RANGE OF HUMIDITY CONDITIONS.

MINIMUM: 20 PERCENT RELATIVE HUMIDITY (RH) FROM THE OPERATING TEMPERATURE TO +16°C. ABOVE +16°C, THE RH SHALL BE BASED ON A DEW POINT OF -7°C

MAXIMUM: 100 PERCENT RH INCLUDING CONDENSATION FROM THE MINIMUM OPERATING TEMPERATURE TO +27°C. ABOVE +27°C, THE RH SHALL BE BASED ON A DEW POINT OF +27°C.

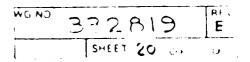


- 3.2.5.6 SALT FOG. THE RFS SHALL MEET THE PERFORMANCE REQUIPEMENTS SPECIFIED HEREIN WHEN EXPOSED TO A SALT ATMOSPHERE IN BOTH AN OPERATING AND NON-OPERATING MODE WHEN TESTED AS SPECIFIED IN MIL-STD-810, METHOD 509.1
- 3.2.5.7 FUNGUS RESISTANCE. THE RFS SHALL RESIST ANY DETRIMENTAL EFFECT ON PERFORMANCE IN BOTH AN OPERATING AND NON-OPERATING MODE BY THE GROWTH OF PUNGUS WHEN TESTED AS SPECIFIED IN MIL-STD-810, METHOD 508.1. ONLY INHERENTLY FUNGUS-INERT MATERIALS SHALL BE USED.
- 3.2.5.8 EXPLOSIVE CONDITIONS. THE RFS SHALL OPERATE WITHOUT DEGRADATION IN AN EXPLOSIVE ATMOSPHERE ON THE GROUND AND WHEN SUBJECTED TO DECREASED BAROMETRIC PRESSURES AT 70,000 PEET WITHOUT CREATING AN EXPLOSION.
- 3.2.5.9 SAND AND DUST. THE RPS SHALL OPERATE AS SPECIFIED WHILE BEING SUBJECTED TO CONDITIONS DEFINED IN MIL-STD-210, PARAGRAPH 5.1.2.1.3 GIVEN CLOSE PROXIMITY TO AIRCRAPT OPERATING OVER UNPAVED SURFACES.
- 3.2.5.10 RAIN. THE RFS SHALL MEET THE PERFORMANCE REQUIREMENTS SPECIFIED HEREIN WHEN EXPOSED TO THE CONDITIONS SPECIFIED IN THE RAINFALL RATE REQUIREMENT OF MIL-STD-210 FOR AN ESTIMATED DURATION OF EXPOSURE (EDE) OF 25 YEARS.
- 3.2.5.11 PRESSURIZATION. THE RPS SHALL WITHSTAND DIFFERENTIAL PRESSURES, AND REDUCED PRESSURE SHALL NOT CAUSE DEGRADATION IN PERFORMANCE BELOW THE REQUIREMENTS OF THIS SPECIFICATION. THE EQUIPMENT SHALL BE COMPLETELY ENCLOSED FOR PROTECTION AGAINST DUST, DIRT OR ANY OTHER CONTAMINANTS. EXTERNALLY INDUCED COOLING AIR, WHICH MAY BE CONTAMINATED BY DIRT AND THE COLLECTION OF WATER, SHALL NOT BE CIRCULATED ACROSS PARTS AND COMPONENTS. PROVISIONS SHALL BE MADE FOR THE DRAINAGE OF CONDENSED MOISTURE.
- 3.2.6 TRANSPORTABILITY. THE RPS SHALL BE TRANSPORTABLE, WITHOUT SPECIAL PACKING PROVISIONS, BY EITHER GOVERNMENT OR COMMERCIAL CARRIERS, INCLUDING BUT NOT LIMITED TO AIR OR SEA SHIPMENT. THE REQUIREMENTS OF MIL-HDBK-157 SHALL APPLY.
- 3.3 DESIGN AND CONSTRUCTION. THE REQUIREMENTS OF MIL-E-5400 AND MIL-E-4158 SHALL APPLY WITH ADDITIONS AND EXCEPTIONS TO THE PARAGRAPHS OF MIL-E-5400 AND MIL-E-4158 AS IDENTIFIED BY SIMILARITY OF PARAGRAPH HEADINGS, CALLED OUT HEREIN. WHEN THE TWO DOCUMENTS CONFLICT, THIS SPECIFICATION SHALL GOVERN. THE RFS DESIGN SHALL EMPHASIZE MINIMUM REQUIREMENTS FOR SUPPORT EQUIPMENT.

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- 3.3.1 MATERIALS, PROCESSES AND PARTS.
- 3.1.1.1 STANDARD AND COMMERCIAL PARTS. ALL STANDARD AND NON-STANDARD PARTS SHALL BE SELECTED IN ACCORDANCE WITH MIL-E-540, MIL-E-4158 AND MIL-STD-956, PROCEDURE 1. MILITARY STANDARD (MS) OR ARMY-NAVY (AN) MATERIALS, PARTS, PROCESSES AND TECHNIQUES SHALL BE USED IN THE RFS DESCRIBED HEREIN, TO THE GREATEST EXTEND PRACTICAL, AND SHALL BE SPECIFIED ON THE DRAWING BY THE MS OR AN NUMBERS AND IN ACCORDANCE WITH DOD-STD-100. SPECIFICATIONS AND STANDARDS FOR MATERIALS, PROCESSES, PARTS AND EQUIPMENT OTHER THAN THOSE SPECIFICALLY DESIGNATED HEREIN SHALL BE SELECTED IN ACCORDANCE WITH THE ORDER OF PRECEDENCE SPECIFIED IN MIL-STD-143.

- 3.3.1.2 PARTS APPROVAL. USE OF ALL NON-STANDARD PARTS WILL REQUIRE PRIOR WRITTEN APPROVAL OF HAZELTINE.
- 3.3.1.2.1 SEMICONDUCTORS. ALL SEMICONDUCTORS SHALL BE SELECTED IN ACCORDANCE WITH MIL-STD-454 REQUIREMENT 30 AND THE FOLLOWING:
 - A. AXIAL LEADED DIODES AND RECTIFIERS SHALL BE OF A SOLID GLASS METALLURGICALLY BONDED CONSTRUCTION. POINT CONTACT DIODES SHALL NOT BE USED.
 - B. WHEN TO-5 AND TO-18 PACKAGES ARE REQUIRED, THEY SHALL BE LIMITED TO THE SOLID METAL HEADER TYPE.
 - C. ALL SEMICONDUCTOR DEVICE JUNCTIONS MUST BE PROTECTED AND NO ORGANIC OR DESICCANT MATERIALS SHALL BE INCLUDED IN THE PACKAGE.
 - D. THERMOCOMPRESSION WEDGE BONDING SHALL NOT BE USED WITH ALUMINUM WIRE.
 - E. ALUMINUM TO-3 PACKAGES SHALL NOT BE USED.
 - F. GERMANIUM DEVICES SHALL NOT BE USED.
 - G. PEAK JUNCTION TEMPERATURES OF SEMICONDUCTORS SHALL NOT EXCEED THE FOLLOWING:
 - (1) POWER DEVICES $+150^{\circ}$ C (302°F)
 - (2) SMALL SIGNAL DEVICES +125°C (257°F)



- 3.3.1.2.2 MICROELECTRONIC DEVICES. ALL MICROELECTRONIC DEVICES SHALL BE SELECTED IN ACCORDANCE WITH REQUIREMENT 64 OF MIL-STD-454 AND THE POLLOWING:
 - A. HYBRID MICROCIRCUITS, INCLUDING RADIO PREQUENCY, MICROWAVE, AND MILLIMETER TYPES, ARE CONSIDERED MICROELECTRONIC DEVICES AND SHALL BE CONTROLLED BY REQUIREMENT 64 OF MIL-STD-454.
 - B. INTEGRATED CIRCUITS SHALL NOT HAVE PEAK JUNCTION TEMPERATURES EXCEEDING 125°C (257°F).
- 3.3.1.2.3 CRITICAL ITEMS. HYBRID (INCLUDING RADIO FREQUENCY, MICROWAVE AND MILLIMETER TYPES) AND COMPLEX MONOLITHIC MICROCIRCUITS ARE CONSIDERED CRITICAL ITEMS AND SHALL BE TREATED IN ACCORDANCE WITH THE RELIABILITY CRITICAL ITEMS REQUIREMENTS OF MIL-STD-785.
- 3.3.1.3 MOUNTINGS. MOUNTINGS POR THE RFS SHALL BE AS SHOWN IN FIGURE 2.
- 3.3.1.4 RELAYS. THE USE OF ELECTROMECHANICAL RELAYS IS DISCOURAGED. WHEN THEY MUST BE USED, THEY SHALL BE SELECTED IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 57.
 - 3.3.1.5 ELECTRONIC DEVICES.
- 3.3.1.5.1 ELECTRON TUBES. EXCEPT FOR RUBIDIUM TUBES, ELECTRON TUBES SHALL NOT BE USED IN THIS EQUIPMENT.
- 3.3.1.5.2 SEMICONDUCTOR DEVICES. ONLY JANTX SEMICONDUCTOR DEVICES SELECTED FROM MIL-STD-701 ARE STANDARD. WHEN A JANTX DEVICE IS NOT LISTED, THE SELECTION OF NON-STANDARD DEVICES SHALL CONFORM TO THE POLLOWING ORDER OF PRECEDENCE.
 - A. A JAN DEVICE LISTED IN MIL-STD-701.
 - B. A JAN DEVICE COVERED BY MIL-S-19500 BUT NOT LISTED IN MIL-STD-701.
 - C. A COMMERCIAL DEVICE.

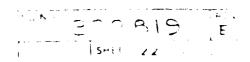
THE DEFINITION OF JANTX, JAN AND TX SHALL BE IN ACCORDANCE WITH MIL-S-19500. AS A MINIMUM, A TX BURN-IN REQUIREMENT IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 30, SHALL BE REQUIRED FOR ALL NON-STANDARD DEVICES.

3.3.1.5.3 HERMETIC PACKAGES. ALL MICROCIRCUITS AND SEMICONDUCTORS SHALL BE PACKAGES IN HERMETIC PACKAGES. NO PLASTIC ENCAPSULATED DEVICES OR POLYMER SEALED DEVICES SHALL BE USED WITHOUT WRITTEN APPROVAL OF HAZELTINE.

- 3.3.1.5.4 HYBRID FILM CIRCUITS AND DISCRETE SEMICONDUCT PEDEVICES. THE USE OF HYBRID FILM CIRCUITS AND DISCRETE SEMICONDUCTOR DEVICES (TRANSISTORS, DIODES) SHALL BE PERMISSIBLE WHEN I. CAN BE SHOWN THAT SUCH USE IS MORE EFFECTIVE IN TERMS OF SIGNIFICANT PERFORMANCE OR LIFE-CYCLE COST GANERSHIP. DISCRETE SEMICONDUCTOR DEVICES SHALL BE IN ACCORDANCE WITH MIL-S-19500. TX (EXTRA TESTING), OR EQUIVALENT, SHALL BE USED TO THE MAXIMUM EXTENT POSSIBLE. HYBRID CIRCUITS SHALL BE IN ACCORDANCE WITH MIL-M-38510, CLASS B.
- 3.3.1.5.5 MICROCIRCUITS. MICROCIRCUITS LISTED IN MIL-SID-1562 AND PROCURED IN ACCORDANCE WITH MIL-M-38510 SHALL BE USED WHENEVER SUCH USE IS FEASIBLE AND COMPATIBLE WITH OTHER REQUIFE-MENTS OF THIS SPECIFICATION. NON-STANDARD DEVICES SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF MIL-M-38510, CLASS B. QUALIFICATION AND SCREENING REQUIREMENTS FOR NON-STANDARD DEVICES WILL BE DETERMINED AS PART OF DEVICE APPROVAL PROCEDURES.
- 3.3.1.6 PREQUENCY STANDARDS. NO PART OF THE RES SHALL REQUIRE FREQUENCY CALIBRATION MORE OFTEN THAN ONCE PER MONTH.
- 3.3.1.7 QUARTZ CRYSTAL UNITS. ALL QUARTS CRYSTAL UNITS USED IN THE RES SHALL BE IN ACCORDANCE WITH MIL-C-3098.
- 3.3.1.8 COMPONENT ORIENTATION. PARTS OR SUB-ASSEMBLIES WHICH COULD CAUSE MALFUNCTION WHEN INSTALLED IMPROPERLY SHALL BE DESIGNED AND FABRICATED SO THAT THEY CAN BE INSTALLED ONLY IN THEIR PROPER OPERATING POSITION.
- 3.3.1.9 CIRCUITS. NO DAMAGE SHALL OCCUR IF THE PES IS OPERATING ALONE OR WITH ASSOCIATED EQUIPMENT AND THE RES SHALL NOT BE DAMAGED WHEN OPERATED WITH AN OPEN OR SHORT CIRCUIT AT ANY OP THE ELECTRICAL OR MECHANICAL INTERFACES.
- 3.3.1.9.1 CIRCUIT ADJUSTMENTS. THE RES SHALL NOT BE DAMAGED WHEN ANY OF THE OPERATING CONTROLS OR SERVICE ADJISTMENTS ARE PLACED IN EXTREME OR INCORRECT POSITIONS. THE NUMBER OF ADJUSTMENTS CONTAINED WITHIN THE RES SHALL BE HELD TO AN ABSOLUTE MINIMUM COMMENSURATE WITH THE STATE-OF-THE-ART AND GOOD ENGINEERING PRACTICE. INTERNAL ADJUSTMENTS SHALL BE ELIMINATED WHEN TECHNICALLY FEASIBLE.

3.3.1.10 FINISHES.

3.3.1.10.1 CASES AND FRONT PANELS. THE CASE AND FRONT PANEL OF THE RFS SHALL BE FINISHED IN ACCORDANCE WITH THE EQUIPMENT COLOR REQUIREMENTS OF MIL-STD-1472.



- 3.3.1.10.2 CONTROL KNOB COLORS. KNOBS AND CONTROLS SHALL BE FINISHED IN ACCORDANCE WITH THE EQUIPMENT COLOR REQUIREMENTS OF MIL-STD-1472.
- 3.3.1.10.3 BASEPLATE. THE BASEPLATE SHALL HAVE A FINISH OF 32 UIN OR BETTER AND A FLATNESS OF 0.003 IN TIR. ALL END AND SIDE PLATES SHALL BE FLUSH OR RECESSED 0.10 IN FROM THE BASEPLATE SURFACE. THE BASEPLATE SHALL BE FINISHED WITH A CHEMICAL FILM PER MIL-C-5541, CLASS 3.
- 3.3.11 CORROSION OF METAL PARTS. CORROSION PROTECTION AND RESISTANCE SHALL BE AS SPECIFIED IN MIL-STD-454, REQUIREMENT 15. DISSIMILAR METALS SHALL BE SELECTED AND PROTECTED IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 16.
- 3.3.1.12 MOISTURE AND FUNGUS RESISTANCE. THE RFS SHALL USE MATERIALS THAT ARE MOISTURE RESISTANT AND ARE NON-NUTRIENT FOR FUNGI. FUNGI-INERT MATERIALS ARE SPECIFIED IN MIL-STD-454, REQUIREMENT 4.
- 3.3.1.13 ENCAPSULATION. MATERIALS USED FOR ENCAPSULATION AND EMBEDMENT SHALL BE SELECTED FOR THEIR OPERATIONAL ENVIRONMENT CONDITIONS. ONLY THOSE MATERIALS WHICH MEET OR EXCEED THE REQUIREMENTS OF MIL-S-8516, MIL-S-23586 AND MIL-I-81550 SHALL BE USED.
- 3.3.2 ELECTROMAGNETIC INTERFERENCE. THE RFS SHALL COMPLY WITH THE POLLOWING ELECTROMAGNETIC INTERFERENCE (EMI) REQUIREMENTS SPECIFIED IN MIL-STD-461 FOR CLASS A1 AND A3 EQUIPMENT:

CE 03, 07

CS 01, 02, 06

RE 02

RS 02, 03

FOR CLASS A1 EQUIPMENT, RS03 SHALL BE EXPANDED TO INCLUDE FREQUENCIES BETWEEN 10 GHz AND 40 GHz AT FIELD STRENGTH OF 20 V/m.

3.3.2.1 TRANSIENT PROTECTION.

A. THE RFS HEATER CIRCUIT SHALL NOT BE ADVERSELY AFPECTED BY POWER HAVING TRANSIENT CHARACTERISTICS
WITHIN THE LIMITS SPECIFIED IN MIL-STD-704, CATEGORY
B. HOWEVER, THE VOLTAGE EXCURSION LIMITS FOR DC
LINE TRANSIENTS SHALL BE EXPANDED TO ±600 VOLTS FOR
0 TO 10 MICROSECONDS, DECREASING LINEARLY (ON SEMILOG SCALE) TO ±140 VOLTS AT 1 MILLISECOND, THEN
LINEARLY TO ±80 VOLTS AT 10 MILLISECONDS. AS APPLIED HEREIN, MIL-STD-704 SHALL BE INTERPRETED AS
COVERING ALL NEGATIVE TRANSIENTS BELOW 40

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(SHEET 23 OF 30	<u>.</u>

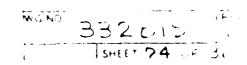
MILLISECONDS IN DURALION AND ALL POSITIVE
TRANSIENTS, HOWEVER SHOW, IN ASSOCIANCE WITH THE
CONVERSION FORMULAS OF THAT DOCUMENT. ADDITIONALLE
THE ZER) DC VOLTAGE POSTION OF MILMITS AND FIGURE
9, LIMIT 4, SHALL EXTEND TO 10 SECONDE, FOILOWED BY
A STEP TO THE ACTUAL CORDE. TRANSIENT SOCIACE
IMPEDANCES SHALL BE PER ARING SPECIFICATION NO. 413
AND IAW THE TABLE BELOW. WHEN THE FULLEMENT IS
OPERATING AND AN INADVENTENT LOWER INTERPUPT OF CLA
(GREATER THAN 50 MILLISECONDS), THE EQUIPMENT SHALL
BE FULLY OPERATIONAL AGAIN WITHIN 10 SECONDS AFTER
THE END OF INTERRUPTION WITHOUT HUMAN ACTION. THE
EQUIPMENT SHALL BE FULLY OPERATIONAL AGAIN IN LESS
THAN 200 MILLISECONDS AFTER THE END OF A MOMENTARY
TRANSIENT LASTING UP TO 50 MILLISECONDS, WITHOUT
HUMAN ACTION.

THE RFS HEATER +28 VDC INPUT FOR GROUND INSTALLATIONS SHALL NOT BE ADVERSELY AFFECTED BY POWER HAVING TRANSIENT CHARACTERISTICS AS DEFINED BY MIL-STD-1275, EXCEPT THAT PERFORMANCE IS NOT REQUIRED DURING THE INITIAL START TRANSIENT (NO LESS THAN SIX VOLTS FOR NOT MORE THAN FOUR SECONDS). THE STEADY STATE VOLTAGE AS DEFINED IN THE STEADY STATE VOLTAGE REQUIREMENTS OF MIL-STD-1275 SHALL BE EQUAL TO OR GREATER THAN 23 VOLTS.

TRANSIENT IMPEDANCES

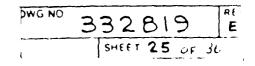
TRANSIENT VO	DLTAGE	DUF	RATION	(±108)
600 V	0	TO 1	MILLISECOND	50 OHMS
80 V	1	- 10	MILLISECONDS	15 OHMS
75 V	10	 5 0	MILLISECONDS	5 OHMS
70 V	50	- 75 0	MILLISECONDS	O.2 OHMS

- B. THE RFS ELECTRONIC CIRCUITS SHALL BE PROTECTED AGAINST THE FOLLOWING POWER CONDITIONS:
 - O VOLTAGE DROP TO 22 VOLTS DC FOR 10 SECUNDS POLLOWED BY STEP TO THE OPIGINAL VOLTAGE.
 - o VOLTAGE TRANSIENTS & 50 V MAX FOR 1 SEC MAX.
- 3.3.2.2 BONDING. THE RFS SHALL COMPLY WITH THE REQUIRE-MENTS OF MIL-B-5087. EQUIPMENT MOUNTED ON RAILS OR TO A STRUC-TURE, SHALL BE INTEGRALLY BONDED BY PREPARED SURFACES AT THE EQUIPMENT TO A STRUCTURE, INTERFACE. MAXIMUM DC RESISTANCE SHALL BE 2.5 MILLIOHMS.

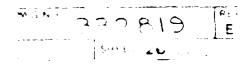


TAMBEDANCE

- 3.3 PRODUCT MARKING. ALL MARKING SHALL BE IN ACCORDANCE WITH MIL-STD-130. PART AND ASSEMBLY MARKING SHALL INCLUDE PART NUMBER AND MANUFACTURER CODE IDENTIFICATION.
- 3.3.4 WORKMANSHIP. WORKMANSHIP SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 9. REWORK OF PRINTED WIRING BOARDS SHALL BE ALLOWED ONLY DURING PRE-PRODUCTION PHASES WHEN A HAZELTINE APPROVED PROCEDURE IS FOLLOWED. A MAXIMUM OF 3 JUMPER WIRES WILL BE ALLOWED FOR EACH PRINTED WIRING ASSEMBLY AND ALL SUCH JUMPERS SHALL BE ELIMINATED BY APPROPRIATE DESIGN CHANGES FOR PRODUCTION.
- 3.3.5 INTERCHANGEABILITY. THE RFS SHALL BE CONSTRUCTED OF EASILY IDENTIFIED MODULES AND SUBASSEMBLIES. ACCESS TO SUBASSEMBLIES, MODULES AND PARTS SHALL REQUIRE A MINIMUM OF TIME AND EFFORT BY MAINTENANCE PERSONNEL.
- 3.3.5.1 COMPONENT PROTECTION. THE RFS, IN OR OUT OF THE CASE, SHALL BE SO CONSTRUCTED THAT NO DAMAGE TO ANY UNIT OR COMPONENT, OR ANY UNDUE DISTORTION TO ANY STRUCTURAL MEMBER WILL BE CAUSED BY PLACING ANY FLAT SIDE OF THE RFS ON A FLAT SURFACE.
- 3.3.5.2 SERVICE AND ACCESS. ACCESS DOORS AND COVERS, IF REQUIRED, SHALL BE SO CONSTRUCTED AND INSTALLED WITH A MINIMUM NUMBER OF FASTENERS CONSISTENT WITH SOUND ENGINEERING PRACTICE.
- 3.3.6 SAFETY. SAFETY ENGINEERING SHALL BE APPLIED THROUGHOUT THE DESIGN, DEVELOPMENT, MANUFACTURER, TEST, OPERATION, AND MAINTENANCE IN ACCORDANCE WITH THE PRINCIPLES OF MIL-STD-882. EQUIPMENT DESIGN SHALL BE IN ACCORDANCE WITH AFSC DH 1-6, SECTION 2C, MIL-STD-454, REQUIREMENTS 1, 3, AND 8, AND THE HAZARDS AND SAFETY REQUIREMENTS OF MIL-STD-1472.
- 3.3.6.1 PERSONNEL SAFETY. SAFETY REQUIREMENTS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 1.
- 3.3.6.2 SYSTEM SAFETY. CONTROL AND MODULAR CONSTRUCTION SHALL BE SUCH THAT OPERATOR/MAINTENANCE PERSONNEL CANNOT INDUCE FAILURES OF THE EQUIPMENT WHILE OPERATING/TESTING/PERFORMING MAINTENANCE IN ACCORDANCE WITH THE TECHNICAL DATA, OPERATIONAL HANDBOOKS AND TEST PROCEDURES PROVIDED.
- 3.3.6.3 CORONA AND ELECTRICAL BREAKDOWN. CORONA AND ELECTRICAL BREAKDOWN PREVENTION SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 45.
- 3.3.6.4 LIGHTNING PROTECTION. THIS EQUIPMENT SHALL BE DESIGNED TO PROVIDE LIGHTNING PROTECTION IN ACCORDANCE WITH MILB-5087.



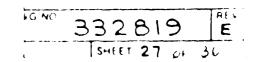
- 3.3.6.5 REVERSE POLARITY PROTECTION. THIS EQUIPMENT SHALL BE PROVIDED WITH A REVERSE POLARITY PROJECTION CIRCUIT THAT PREVENTS DAMAGE TO ANY PART OF THE EQUIPMENT BY INADVERTENT CONNECTION TO A DC POWER SOURCE HAVING THE WRONG POLARITY.
- 3,3.7 HUMAN PERFORMANCE/HUMAN ENGINEERING. THE FFS SHALL REFLECT THE APPLICATION OF HUMAN ENGINEERING AS DEFINED BY MIL-H-46855. AFSC DH 1-3 SHALL BE USED AS A GUIDE. THE DETAILED DESIGN SHALL BE IN ACCORDANCE WITH MIL-STD-1472. PARAGRAPHS 5.10, 5.12, AND 5.14 OF MIL-STD-1472 DO NOT APPLY.
- 3.4 DOCUMENTATION. DOCUMENTATION, INCLUDING TEST PLANS, PROCEDURES, SPECIFICATIONS, DRAWINGS, AND TECHNICAL ORDERS SHALL BE PROVIDED IN ACCORDANCE WITH CONTRACT DATA REQUIREMENTS.
- 3.5 LOGISTICS. THIS EQUIPMENT SHALL BE DESIGNED TO MINIMIZE LIFE-CYCLE-COST CONSISTENT WITH PERPORMANCE TO MEET MISSION NEEDS. THE INTERFACE REQUIREMENTS AND LOGISTICS DISCIPLINES OF DDD-5000.39 SHALL BE INTEGRATED INTO THE DESIGN AND ENGINEERING CONSTRAINTS CITED IN OTHER SECTIONS OF THIS SPECIFICATION.
- 3.5.1 MAINTENANCE. THE MAINTAINABILITY REQUIREMENTS AND CRITERIA FOR MAINTAINABILITY DESIGN ARE ESTABLISHED IN 3.2.4 HEREIN. SCHEDULED OR PREVENTIVE MAINTENANCE, EXCLUDING NORMAL HOUSEKEEPING CHORES, SUCH AS CLEANING OR REPLACEMENT OF AIR FILTERS, CLEANING OF EXTERIOR SURFACES, ETC., SHALL NOT REQUIRE MORE THAN 0.1 HOUR TO ACCOMPLISH EXCLUDING WARM-UP TIME. THE FREQUENCY OF SUCH SCHEDULED OR PREVENTIVE MAINTENANCE SHALL NOT BE MORE OFTEN THAN 30 DAYS. THE RFS SHALL INCLUDE BIT CIRCUITRY AND OTHER FEATURES TO ENABLE MAINTENANCE.
- 3.5.1.1 MAINTENANCE REQUIREMENTS. THE RFS SHALL BE DESIGNED TO MINIMIZE THE REQUIREMENTS FOR SPARES AND SUPPLY SUPPORT, SUPPORT EQUIPMENT, AND SKILL LEVEL AND TRAINING OF MAINTENANCE PERSONNEL. IT SHALL UTILIZE TO THE MAXIMUM EXTENT FEASIBLE THE CURRENTLY OPERATIONAL LOGISTICS SYSTEMS THAT ARE SUPPORTING UHF RADIOS AND OTHER EXISTING ELECTRONICS ON THE HOST PLATFORMS.
- 3.5.1.2 FAULT DETECTION AND ISOLATION. PAULTS SHALL BE DETECTED AND ISOLATED BY A COMBINATION OF BUILT-IN TEST (BIT) CIRCUITS AND EXTERNAL SUPPORT EQUIPMENT. THESE TECHNIQUES, IN CONJUNCTION WITH OPERATOR OBSERVATIONS, SHALL ENABLE THE PERFORMANCE OF THE POLLOWING BASIC PAULT DETECTION AND ISOLATION STEPS:
 - A. RECOGNITION THAT A PAULT EXISTS.



- B. ISOLATION OF THE FAULT TO A POINT AT WHICH REPAIR CAN EFFECTIVELY BE ACHIEVED AT THE OPERATING LOCATION.
- C. NO LESS THAN 98.6 PERCENT OF THE FAULTS SHALL BE DETECTED USING BUILT IN TEST.
- D. USING TECHNICAL ORDERS (TO) AND A COMBINATION OF INDICATORS, TEST POINTS, SELF TEST CIRCUITRY, TEST JACKS, AUTHORIZED TEST EQUIPMENT AND DIAGNOSTIC COMPUTER PROGRAMS, 100 PERCENT OF THE DETECTED PAULTS SHALL BE ISOLATED TO A SINGLE ASSEMBLY IDENTIFIED AS REPLACEABLE OR REPAIRABLE FOR THE GIVEN MAINTENANCE LEVEL, WITHIN THE REPAIR TIME CONSTRAINTS OF 3.2.4.
- E. THE RATIO OF FALSE DETECTIONS OF A PAULT TO PAULTS DETECTED SHALL BE NO GREATER THAN 0.01.
- 3.5.1.3 TEST POINTS. TEST POINTS FOR INTERCONNECTING TEST AND SUPPORT EQUIPMENT SHALL BE PROVIDED FOR DETERMINING THE PERFORMANCE OF THIS EQUIPMENT AND FOR PERFORMING ORGANIZATIONAL AND INTERMEDIATE MAINTENANCE. TEST POINTS SHALL MEET THE REQUIREMENTS OF MI'L-STD-415, CLASS C. TEST POINTS SHALL BE DESIGNED AND PLACED WITH DHE CONSIDERATION FOR ISOLATION AND SAFETY. ALL COMPONENTS, CONNECTORS, AND ASSEMBLIES SHALL BE READILY IDENTIFIED AS TO REFERENCE DESIGNATOR AND LOCATION. CIRCUIT BREAKERS SHALL BE EASILY ACCESSIBLE. ALL CONNECTORS SHALL BE APPROPRIATELY KEYED TO PREVENT IMPROPER INSERTION OR CONNECTION TO THE WIRING TERMINAL.
- 3.5.2 SUPPLY. THIS EQUIPMENT SHALL BE DESIGNED TO MAKE MAXIMUM USE OF STANDARD APPROVED ITEMS THAT ARE FROM QUALIFIED PRODUCT LISTS AND ARE ALREADY CATALOGED IN THE DOD SUPPLY SYSTEM. DESIGNERS SHALL CONSIDER THE COST OF INTRODUCING NEW EQUIPMENTS OR ITEMS, THE COST OR RESUPPLY, AND THE DISTRIBUTION/LOCATION OP SYSTEM STOCKS.
- 3.5.3 FACILITIES AND FACILITY EQUIPMENT. THE RES SHALL BE DESIGNED TO BE MAINTAINED AND REPAIRED USING, TO THE MAXIMUM EXTENT POSSIBLE, THE STANDARD (COMMON) SUPPORT EQUIPMENT THAT IS IDENTIFIED IN MIL-HDBK-300. ONLY AS A LAST RESORT SHOULD NEW MAJOR ITEMS OF SUPPORT EQUIPMENT BE INTRODUCED INTO BASE OR DEPOT INVENTORIES.

3.6 PERSONNEL AND TRAINING.

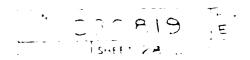
3.6.1 PERSONNEL. THE RFS SHALL BE DESIGNED FOR OPERATION AND MAINTENANCE BY PERSONNEL WHO HAVE RECEIVED APPROPRIATE TRAINING.



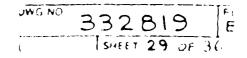
3.6.2 TRAINING. TO THE EXTENT PRACTICAL, EXISTING OPERATIONAL EQUIPMENT AND STANDARD THAINING DEVICES SHALL BE USED. FOR BOTH OPERATIONS AND MAINTENANCE TRAINING.

4. QUALITY ASSURANCE PROVISION .

- 4.1 GENERAL. THIS SECTION EDTA-LISHES THE PECULREMENTS PURTHE FORMAL VERIFICATION OF THE PERFORMANCE REQUIREMENTS SET FORTH IN SECTION 3. THE OBJECTIVE OF THESE VERIFICATIONS IS TO PROVICE ASSURANCE THAT THE REQUIREMENTS AND CHARACTERISTICS IN SECTION 3 ARE MET BY THE DESIGN. SUCCESSFUL COMPLETION OF THE VERIFICATION SHALL CONSTITUTE COMPLIANCE WITH SECTION 3. SUCCESS SHALL BE DETERMINED BASED ON THE SUCCESS CRITERIA SET FORTH IN SECTION 4 HEREIN. IF ANY OUT-OF-SPECIFICATION TEST RESULTS ARE OBSERVED, IMMEDIATE NOTIFICATION SHALL BE MADE TO HAZELTINE ALONG WITH A SUGGESTED APPROACH FOR RESOLVING THE PROBLEM. THE QUALITY ASSURANCE PROVISIONS SHALL INCLUDE THE FOLLOWING ACTIVITIES.
 - A. SPECIAL TEST AND EXAMINATIONS CONSISTING OF:
 - 1. MATERIALS, PARTS AND PROCESSES
 - 2. PROGUREMENT TESTS, AND
 - 3. ENGINEERING TESTS AND EVALUATION
 - B. QUALITY CONFORMANCE INSPECTIONS CONSISTING OF SUBCONTRACTOR DEVELOPMENT TESTS AND EVALUATIONS AND ACCEPTANCE TESTS.
- 4.1.1 RESPONSIBILITY FOR TESTS. THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR THE CONDUCT OF ALL TESTS AND INSPECTIONS HEREIN. ALL TEST PLANS, INSTRUCTIONS, AND DIRECTIVES SHALL BE WRITTEN BY THE SUBCONTRACTOR AND SUBJECT TO THE APPROVAL BY HAZELTINE PRIOR TO THE EXECUTION OF THE TEST.
- 4.1.2 SPECIAL TESTS AND EXAMINATIONS. THESE TESTS AND INSPECTIONS SHALL BE CONDUCTED BY THE SUBCONTRACTOR AND REVIEWED BY HAZELTINE OR ITS DESIGNATED REPRESENTATIVE ON SELECTED PARTS AND PROCESSES USED IN THE DESIGN AND CONSTRUCTION OF THE RES.
- 4.1.2.1 MATERIAL, PARTS AND PROCESSES. INSPECTION, MEASUREMENTS, TEST OF ANALYSIS AS ALEXAPPRIATE SHALL BE CONDUCTED TO ENSURE THAT MATERIAL, PARTS, AND PROCESSES SATISFY THE REQUIREMENTS SPECIFIED IN 3.3.1 HEREIN.
- 4.1.2.1.1 DESIGN AND CONSTRUCTION FRACTICES. DESIGN AND CONSTRUCTION PRACTICES SHALL BE VERIFIED BY MECHANICAL AND VISUAL INSPECTION TO ENSURE THAT THEY CONFORM TO THE REQUIREMENTS OF 3.3 HEREIN.



- 4.1.2.2 PROCUREMENT TESTS. RECEIVING INSPECTION TESTS SHALL BE PERFORMED AS APPLICABLE ON MAJOR PROCURED ITEMS. THE ITEMS MAY BE TESTED AT THE MANUFACTURER'S FACILITY. THESE TESTS SHALL INCLUDE, BUT NOT NECESSARILY BE LIMITED TO: VISUAL AND MECHANICAL INSPECTIONS, GROSS FUNCTIONAL TESTS AND DOCUMENTATION INSPECTIONS.
- 4.1.2.3 ENGINEERING TESTS AND EVALUATION. ENGINEERING TEST AND EVALUATION SHALL BE CONDUCTED AS REQUIRED TO SUPPORT ENGINEERING DEVELOPED AND DESIGN. THESE TESTS AND EVALUATIONS ARE TO BE PERFORMED IN PARALLEL WITH DEVELOPMENT TO PROVIDE A MEANS FOR EARLY DETECTION AND CORRECTION OF PERFORMANCE AND DESIGN DEFICIENCIES. COPIES OF ENGINEERING TEST DATA SHALL BE MADE AVAILABLE TO HAZELTINE UPON REQUEST.
- 4.2 QUALITY CONFORMANCE. SUBCONTRACTOR DEVELOPMENT TEST AND EVALUATION (SDT&E) SHALL VERIFY THAT THE DESIGN OF THE RFS MEETS ALL OF THE SPECIFIED PERFORMANCE, ENVIRONMENTAL, RELIABILITY, AND MAINTAINABILITY REQUIREMENTS.
- 4.2.1 VERIFICATION METHODS. COMPLIANCE WITH REQUIREMENTS SHALL BE VERIFIED BY ONE OR MORE OF THE FOLLOWING METHODS:
 - A. INSPECTION. VERIFICATION BY A VISUAL EXAMINATION OF THE RFS, REVIEWING DESCRIPTIVE DOCUMENTATION, GAUGING OR MEASUREMENT, AND COMPARING THE APPROPRIATE CHARACTERISTICS WITH A PREDETERMINED STANDARD TO DETERMINE CONFORMANCE TO REQUIREMENTS WITHOUT THE USE OF SPECIAL LABORATORY EQUIPMENT OR PROCEDURES.
 - B. ANALYSIS. VERIFICATION BY TECHNICAL/MATHEMATICAL EVALUATION USING MATHEMATICAL REPRESENTATIONS (I.E., MATHEMATICAL HODELS, ALGORITHMS, EQUATIONS), CHARTS, GRAPHS, CIRCUIT DIAGRAMS, DATA REDUCTION AND/OR REPRESENTATIVE DATA TO SHOW THAT THE REQUIREMENTS HAVE BEEN MET.
 - C. DEMONSTRATION. VERIFICATION OF OPERATION, MOVEMENT, AND/OR ADJUSTMENT OF THE RFS UNDER A SPECIFIC CONDITION TO PERFORM THE DESIGN FUNCTION WITHOUT RECORDING OF QUANTITATIVE DATA EXCEPT FOR CHECK SHEETS. THE RFS MAY BE INSTRUMENTED AND QUANTITATIVE LIMITS OF PERFORMANCE MONITORED, BUT ACTUAL DATA IS NOT REQUIRED TO BE RECORDED.
 - D. TEST. VERIFICATION THROUGH THE SYSTEMATIC EXERCISTING OF THE RFS UNDER ALL APPROPRIATE CONDITIONS WITH INSTRUMENTATION AND COLLECTION/ANALYSIS/EVALUATION OF QUANTITATIVE DATA.



- 4.2.2 SUBCONTRACTOR DEVELOPMENT TEST AND EVALUATION. SDILE SHALL VERIFY THAT THE RFS DESIGN SATISFIES THE PERFORMANCE AND ENVIRONMENTAL REQUIREMENTS OF 3.0 HEREIN. VERIFICATION SHALL BE PERFORMED IN TWO STAGES, PRELIMINARY QUALIFICATION TESTS AND PORMAL QUALIFICATION TESTS.
- 4.2.2.1 PRELIMINARY QUALIFICATION TESTS (POT). THE FRS SHALL BE SUBJECTED TO PRELIMINARY QUALIFICATION TESTS IN ORDER TO VERIFY THAT THE DESIGN APPROACH AND CONSTRUCTION PRACTICES COMPLY WITH THE REQUIREMENTS OF 3.0 HEREIN USING THE VERIFICATION METHODS DEFINED IN 4.0 HEREIN AND TO ENSURE THE RFS IS READY TO BEGIN FORMAL QUALIFICATION TESTING. ENGINEERING DEVELOPMENT TEST DATA, WHERE APPLICABLE AND SUPPORTED BY ENGINEERING RATIONALE, MAY BE SUBSTITUTED FOR SELECTED PRELIMINARY QUALIFICATION TESTS. SUBSTITUTION OF ALL SUCH DATA IS SUBJECT TO APPROVAL BY HAZELTINE.
- 4.2.2.2 FORMAL QUALIFICATION TESTS (FQT). PORMAL QUALIFICATION TESTS SHALL BE CONDUCTED AFTER SATISFACTORY COMPLETION OF PQT. FQT SHALL BE PERFORMED IN ACCORDANCE WITH THE VERIFICATION METHODS INDICATED IN TABLE I. THE PURPOSE OF PORMAL QUALIFICATION TESTS SHALL BE TO VERIFY COMPLIANCE WITH ALL REQUIREMENTS OF 3.0 HEREIN. THE TESTS SHALL BE CONDUCTED USING TEST PLANS AND PROCEDURES PREPARED BY THE CONTRACTOR AND APPROVED BY HAZELTINE. THE SUBCONTRACTOR SHALL NOTIFY HAZELTINE AT LEAST ONE WEEK PRIOR TO THE START OF ANY QUALIFICATION TESTING SO THAT HAZELTINE AND/OR A GOVERNMENT REPRESENTATIVE MAY WITNESS THE TESTS AT THEIR DISCRETION.
- 4.2.2.2.1 FUNCTIONAL PERFORMANCE TESTS. PUNCTIONAL PERFORMANCE TESTS SHALL BE PER AN APPROVED TEST PROCEDURE TO VERIFY COMPLIANCE WITH 3.2.1 HEREIN AT ROOM TEMPERATURE.
- 4.2.2.2.2. ENVIRONMENTAL COMPLIANCE. ANALYSES AND TESTS SHALL BE PERFORMED TO VERIFY THAT THE EQUIPMENT IS CAPABLE OF WITHSTANDING AND/OR OPERATING UNDER THE SERVICE AND INDUCED CONDITIONS SPECIFIED IN 3.2.5. THE VERIFICATION METHOD TO BE USED IS GIVEN IN TABLE I. FOR TEST REQUIRING EQUIPMENT OPERATION, SOFTWARE AND HARDWARE SHALL OPERATE AT NORMAL CONDITIONS OF VOLTAGE, FREQUENCY, AND COOLING CONSISTENT WITH AMBIENT TEST CONDITIONS; UNLESS SPECIFIED OTHERWISE BELOW OR IN THE APPLICABLE MIL-STD-810 TEST METHOD.

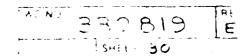


	TABLE I	
VERIFIC	ATION METHOD FOR ENVIRONMEN	TAL COMPLIANCE
REQUIREMENTS PARAGRAPH	TITLE	VERIFICATION METHOD
3.2.5	ENVIRONMENTAL CONDITIONS, MIL-E-4158 AND MIL-E-5400, CLASS 2 EXCEPT AS SPECIFIED IN 3.2.5.1 TO 3.2.5.11	
3.2.5.1.1	OPERATING TEMPERATURE	TEST AS PART OF TEMPERATURE/ALTITUDE
3.2.5.1.2	STORAGE TEMPERATURE	TEST AS PART OF TEMPERATURE/ALTITUDE
3,2,5,1,3	TRANSIENT TEMPERATURE	TEST AS PART OF TEMPERATURE/ALTITUDE
3.2.5.1.4	TEMPERATURE SHOCK	TEST IAW MIL-STD-81(METHOD 503.1, PROCEDURE I
3.2.5.1.5	TEMPERATURE/ALTITUDE	TEST IAW MIL-STD-810 METHOD 504.1, PROCEDURE I, CATEGORY 6 AND AS SPECIFIED IN 3.2.5.1.5
3.2.5.2.1	BENCH HANDLING SHOCK	TEST IAW MIL-STD-81 METHOD 516.2, PROCEDURE V AND AS SPECIFIED IN 3.2.5.2.1
3.2.5.2.2	OPERATIONAL SHOCK	TEST IAW MIL-STD-81 METHOD 516.2, PROCEDURE I AND AS SPECIFIED IN 3.2.5.2.2
3.2.5.2.3	ACCELERATION	TEST IAW MIL-STD-81 METHOD 513.2 PROCEDURE II
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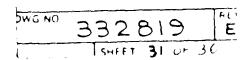
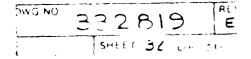


TABLE I

VERIFICATION METHOD FOR ENVIRONMENTAL COMPLIANCE (CONT)

REQUIREMENT PARAGRAPH	TITLE	VERIFICATION METHOD
3.2.5.3	VIBRATION	TEST IAW THE GENERAL REQUIREMENTS OF MIL-STD-810 METHOD 514.2 AND AS SPECIFIED IN 3.2.5.3
3.2.5.4	ACOUSTIC NOISE	TEST IAW MIL-STD-810 METHOD 515.2, CATEGORY A, PROCEDURE I
3.2.5.5	HUMIDITY	TEST IAW MIL-STD-810 METHOD 507.1, PROCEDURE II
3.2.5.6	SALT POG	TEST IAW MIL-STD-810 METHOD 509.1, PROCEDURE I
3.2.5.7	PUNGUS RESISTANCE	CONTRACTOR CERTIFI- CATION OR TEST IAW MIL-STD-810 METHOD 508.1, PROCEDURE I
3.2.5.8	EXPLOSIVE CONDITIONS	TEST IAW MIL-STD-810 METHOD 511.1, PROCEDURE I
3.2.5.9	SAND AND DUST	TEST IAW MIL-STD-810 METHOD 510.1, PROCEDURE I
3.2.5.10	RAIN	TEST IAW MIL-STD-810 TEST METHOD 506.1, PROCEDURE I
3.2.5.11	PRESSURIZATION	TEST AS PART OF TEMPERATURE/ALTITUDE



- 4.2.2.2.3 RELIABILITY VERIFICATION. THE RELIABILITY REQUIREMENTS OF 3.2.3 SHALL BE VERIFIED BY A PREDICTION IN ACCORDANCE WITH MIL-HDBK-217, SECTION 2, PARTS STRESS RELIABILITY. THE PREDICTION RESULTS SHALL INDICATE PART TYPE, GENERIC MANUFACTURER OR MILITARY PART NUMBER, PART VALUE WHERE APPLICABLE, PART STRESS, AND FAILURE RATE FOR ALL PARTS SUCH THAT TRACE-ABILITY EXISTS TO THE FAILURE RATE DERIVED FROM MIL-HDBK-217. VERIFICATION TESTING MAY BE PERFORMED BY HAZELTINE AS PART OF A SET (SYSTEM) LEVEL TEST. DURING THIS TEST, THE RFS WILL BE OPERATED WITHIN THE ENVIRONMENTAL LIMITS SPECIFIED HEREIN. THE SUBCONTRACTOR IS REQUIRED TO SUPPORT THIS TEST BY ANALYZING AND IMPLEMENTING CORRECTIVE ACTION, INCLUDING REDESIGN IF NECESSARY, POR ALL PAILURES OF THE RFS WHICH OCCUR DURING THIS TEST. DURING THIS TEST, THE MINIMUM ACCEPTABLE MTBF SHALL BE AS PER 3.2.3 OF THIS DOCUMENT AND FAILURE TO EXHIBIT THIS MTBF SHALL BE CONSIDERED A RELIABILITY TEST FAILURE.
- 4.2.2.2.4 MAINTAINABILITY VERIFICATION. DEMONSTRATION OF COMPLIANCE WITH THE FAULT DETECTION REQUIREMENTS SHALL BE ACCOMPLISHED BY ANALYSIS. THE METHOD OF ANALYSIS SHALL BE PROPOSED BY THE SUBCONTRACTOR AND APPROVED BY HAZELTINE. VERIFICATION OF THE MCT REQUIREMENTS OF 3.2.4.1.2 SHALL BE ACCOMPLISHED BY A REPAIR TIME PREDICTION.

THE REPAIR TIME PREDICTION SHALL UTILIZE THE ELEMENTAL TIME APPROACH OF MIL-HDBK-472 PROCEDURE IIB TO DETERMINE THE REPAIR TIME FOR A MINIMUM OF 50 TASKS. THE TASKS SHALL BE SELECTED USING THE RANDOM TECHNIQUES OF MIL-HDBK-472, PROCEDURE III.

ADDITIONAL VERIFICATION OF THE QUANTATIVE FAULT DETECTION, REQUIREMENTS MAY BE PERFORMED BY TESTING AT HAZELTINE AS PART OF A SYSTEM. THE SUBCONTRACTOR WILL BE REQUIRED TO SUPPORT THIS TEST BY IMPLEMENTING CORRECTIVE ACTION, INCLUDING REDESIGN, IN THE EVENT THAT THE TEST RESULTS INDICATE THAT THE RFS FAILS TO MEET ANY OF ITS REQUIREMENTS.

4.2.2.2.5 EMC/EMI TESTS. VERIFICATION OF THE REQUIREMENTS OF 3.3.2 HEREIN SHALL BE IN ACCORDANCE WITH MIL-STD-462, AND THE EMI TEST PLAN APPROVED BY HAZELTINE.

4.2.3 ACCEPTANCE TESTING.

4.2.3.1 ENVIRONMENTAL STRESS SCREENING (ESS). EACH UNIT SHALL BE SUBJECTED TO A MINIMUM ESS CONSISTING OF 50 "ON" HOURS, I.E., OPERATING HOURS, IN ACCORDANCE WITH THE PROFILE GIVEN IN FIGURE 3. THE TEST SHALL BE CONDUCTED AT AMBIENT PRESSURE CONDITIONS. A BASELINE PERFORMANCE TEST SHALL BE PERFORMED PRIOR TO THE START OF THE TEST AND DURING EACH HOT (71°C) TEMPERATURE STABILIZATION PERIOD. PERFORMANCE SHALL BE CHECKED AT LEAST ONCE EVERY 10 OPERATING HOURS AND FAILURES REPAIRED AS THEY ARE

PWG NO	332819	REV
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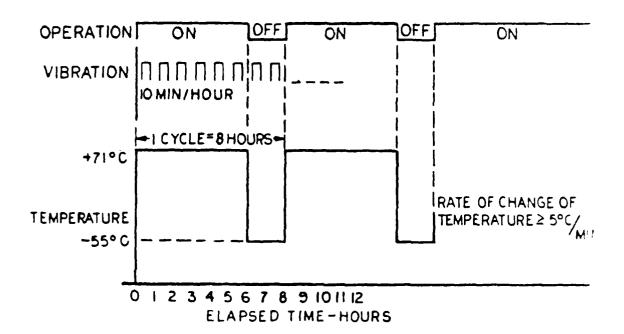
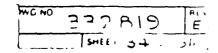


FIGURE 3-ESS CYCLE



IDENTIFIED. IF A PAILURE IS DETECTED, THE OPERATING TIME SINCE THE LAST SUCCESSFUL CHECK SHALL NOT BE COUNTED. ONLY ESS TIME ACCUMULATED WHEN THE EQUIPMENT IS IN A NON-PAILED CONDITION WILL BE COUNTED TOWARD THE 50 "ON" HOUR REQUIREMENT. THE LAST THREE THIS REQUIREMENT SHALL BE SATIS-CYCLES SHALL BE FAILURE PREE. FIED TO THE EXTENT THAT THE ESS CAN BE EXTENDED BEYOND THE 50 "ON" HOURS. THE TEMPERATURE SHALL BE CYCLED PER PIGURE 3. THE RATE OF CHANGE OF TEMPERATURE SHALL BE NO LESS THAN 50°C/MIN AND VIBRATION SHALL BE THE SAME AS THAT PROVIDED FOR THE PRODUCTION RELIABILITY ACCEPTANCE TEST (OPTION I, PARAGRAPH 4.4.1 OF MIL-STD-781, EXCEPT THAT THE MAXIMUM ACCELERATION SPECTRAL DENSITY SHALL BE $0.04~\rm G^2/Hz$ AND SHALL BE APPLIED FOR 10 MINUTES EACH HOUR). THE INPUT VOLTAGE SHALL REMAIN CONSTANT DURING ESS. SHOCK MOUNTS SHALL NOT BE USED. THE SUBCONTRACTOR SHALL NOTIFY HAZELTINE AT LEAST ONE WEEK PRIOR TO THE START OF ACCEPTANCE TESTING SO THAT HAZELTINE AND/OR A GOVERNMENT REPRESENTATIVE MAY WITNESS THE TESTS AT THEIR DISCRETION.

4.2.4 NOTES ON PERFORMANCE TESTING. THE PARAMETERS THAT SHALL BE TESTED BY THE CONTRACTOR DURING QUALIPYING TESTS TO VERIFY THE UNITS SATISFY THE REQUIREMENTS SPECIFIED IN 3.2.1 SHALL, AS A MINIMUM, INCLUDE THE PARAMETERS SPECIFIED IN 3.2.1.1, 3.2.1.2, 3.2.1.7, AND 3.2.1.8. THESE PARAMETERS SHALL BE USED BY THE CONTRACTOR IN PREPARING TEST PLANS WHICH SHALL BE APPROVED BY HAZELTINE.

ALL PARAMETERS SHALL BE TESTED UNDER ALL CONDITIONS DEFINED IN TABLE I. EXTREMES OF CONDITIONS AND POINTS WITHIN EXTREMES SHALL BE TESTED TO ASSURE HAZELTINE THAT ALL RFS'S WILL WORK AS SPECIFIED HEREIN.

5. PREPARATION FOR DELIVERY. ALL ITEMS TO BE DELIVERED IN ACCORDANCE WITH THE TERMS OF THE CONTRACT SHALL BE PREPARED FOR SHIPMENT WITH THE APPROPRIATE PRESERVATION PACKAGING, PACKING AND MARKING SUCH THAT ADEQUATE PROTECTION IS AGAINST CORROSION, DETERIORATION AND PHYSICAL DAMAGE DURING SHIPMENT AND HANDLING PROM THE SOURCE OF SUPPLY TO THE ULTIMATE DESTINATION.

6. NOTES.

MANAGE COCOSCIA

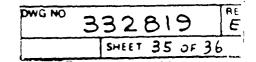
いっているとは、これのことのでは、これのことととととという。

6.1 ACRONYMS AND ABBREVIATIONS. THE ACRONYMS AND THE ABBREVIATIONS USED IN THIS SPECIFICATION ARE DEFINED AS FOLLOWS:

AFSC AIR FORCE SYSTEMS COMMAND

BIT BUILT-IN TEST
BW BAND IDTH

EDE ESTIMATED DURATION OF EXPOSURE
ESS ENVI: ONMENTAL STRESS SCREENING



PEDB PAILURE EXPERIENCE DATA BANK POT FORMAL QUALIFICATION TEST

GIDEP GOVERNMENT INDUSTRY DATA EXCHANGE PROGRAM

JAN JOINT ARMY NAVY

JANTX JOINT ARMY NAVY EXTRA TESTING

K PACTOR ADDITIONAL LENGTH REQUIRED FOR CONNECTORS

AND HANDLES

LRU LINE REPLACEMENT UNIT

 R_{CT} MEAN CORRECTIVE MAINTENANCE TIME MMAXCT MAXIMUM CORRECTIVE MAINTENANCE TIME

MPT MS PREVENTIVE MAINTENANCE TIME

MILITARY STANDARDS

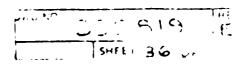
POT PRELIMINARY QUALIFICATION TEST

ROT RELIABILITY QUALIFICATION TEST RFS RUBIDIUM FREQUENCY STANDARD

SDT&E SUBCONTRACTOR DEVELOPMENT TEST & EVALUATION

TX EXTRA TESTING TO TECHNICAL ORDERS

UDL UNIT DETAIL LISTING





RELIABILITY PREDICTION

RELIABILITY PREDICTION FOR TACTICAL RUBIDIUM FREQUENCY STANDARD (TRFS)

eserce application



ASSURANCE TECHNOLOGY CORPORATION

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Prepared For

E G & G FREQUENCY PRODUCTS DIVISION
35 Congress Street
Salem, Massachusetts 01970

27 NOVEMBER 1985

Assurance Technology Corporation (ATC) is an engineering and management consulting firm dedicated to the resolution of the technical and management problems inherent in the design, development, manufacture, and use of today's complex hardware and software systems.

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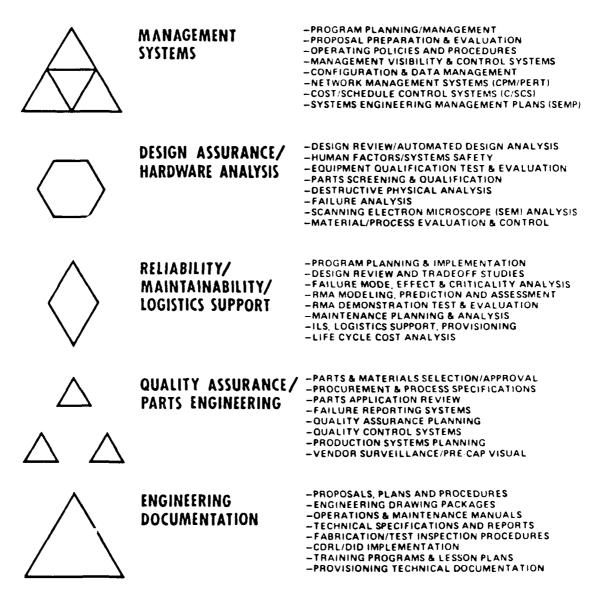


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1.0 INTRODUCTION

This report documents the results of a reliability prediction performed on the Tactical Rubidium Frequency Standard (TRFS) developed by the E G & G Frequency Products Division of Salem, Massachusetts.

The purpose of this prediction, which was conducted in accordance with the detailed parts stress procedure of paragraph 5-1 of MIL-HDBK-217D (with Notice 1), was to predict the mean time between failures (MTBF) of the TRFS for three (3) different sets of environment/cooling air temperature conditions.

Section 2.0 presents the summary results of the TRFS reliability prediction, while Section 3.0 describes the reliability mathematical model which was used in performing the prediction. In Section 4.0 the detailed part level stress and reliability data are compiled.

2.0 SUMMARY RESULTS

The reliability prediction performed on the TRFS indicates that for each of the three (3) environment/cooling air temperature conditions, the predicted MTBF of the TRFS exceeds the MTBF requirement specified in paragraph 3.2.3 of Hazeltine Corporation Specification Number 332819. This information is summarized in Table 2-1.

TABLE 2-2
TRFS MTBF PREDICTION SUMMARY

	COOLING AIR	MTBF (HOURS)
ENVIRONMENT	TEMPERATURE	SPECIFIED	PREDICTED
Airborne Uninhabited, Fighter (AUF)	2°C	12,975	23,683
Ground Fixed (GF)	30°C	34,408	101,802
Ground Mobile (GM)	40°C	21,352	36,224

The prediction was performed utilizing detailed parts stress analysis data and localized TRFS assembly thermal data developed by E G & G engineering personnel and reflects the use of B, B-O or B-1 quality level integrated circuits, JANTX quality level discrete semiconductors and "M" quality level passive components. Table 2-2 provides a matrix of predicted failure rate by assembly by environment/cooling air conditions for the TRFS.

TABLE 2-2 TRFS PREDICTED FAILURE RATE BY ASSEMBLY

CONTRACT CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR

ENVIRONMENT/COOLING AIR TEMP AUF @ 2°C		REF	PREDICT	PREDICTED FAILURE RATE (FPMH)	(FPMH)
4-1A, B, C 0.944 0.200 4-2A, B, C 2.787 0.686 4-3A, B, C 2.787 0.085 4-4A, B, C 8.164 2.921 4-5A, B, C 8.164 2.921 4-5A, B, C 2.669 0.178 4-6A, B, C 7.059 1.427 4-7A, B, C 11.280 1.967 4-8A, B, C 11.280 0.769 6 Misc. Parts 4-10A, B, C 3.886 1.097 e Totals: 4-10A, B, C 3.886 1.097 (HOURS): 23,683 101,802	TRFS ASSEMBLY	TABLES	ENVIRONMEN	T/COOLING AIR TH	EMPERATURE
4-1A, B, C 0.944 0.200 4-2A, B, C 2.787 0.686 4-3A, B, C 0.417 0.057 4-4A, B, C 8.164 2.921 4-5A, B, C 2.669 0.178 4-5A, B, C 7.059 1.427 4-6A, B, C 7.059 1.427 4-7A, B, C 11.280 1.967 5 Misc. Parts 4-9A, B, C 1.843 0.521 4-10A, B, C 3.886 1.097 e Totals: 4-10A, B, C 3.886 1.097 e Totals: 23,683 101,802 3			AUF @ 2°C	GF @ 30°C	GM @ 40°C
4-2A, B, C 2.787 0.686 4-3A, B, C 0.417 0.057 4-4A, B, C 8.164 2.921 4-5A, B, C 2.669 0.178 4-6A, B, C 7.059 1.427 4-7A, B, C 11.280 1.967 4-7A, B, C 11.280 0.769 6 Misc. Parts 4-9A, B, C 1.843 0.521 4-10A, B, C 3.886 1.097 6 Misc. Parts 4-10A, B, C 3.886 1.097 6 Misc. Parts 4-10A, B, C 3.886 1.097	Pre-Amp PWB	4-1A, B, C	0.944	0.200	0.560
4-3A, B, C 0.417 0.057 4-4A, B, C 8.164 2.921 4-5A, B, C 2.669 0.178 4-6A, B, C 7.059 1.427 4-7A, B, C 11.280 1.967 4-7A, B, C 3.176 0.769 6 Misc. Parts 4-9A, B, C 1.843 0.521 4-10A, B, C 3.886 1.097 4-10A, B, C 3.886 1.097 4-10A, B, C 3.886 1.097	VCXO PWB		2.787	0.686	1.370
4-4A, B, C 8.164 2.921 4-5A, B, C 2.669 0.178 4-6A, B, C 7.059 1.427 4-7A, B, C 11.280 1.967 4-8A, B, C 3.176 0.769 6 Misc. Parts 4-9A, B, C 1.843 0.521 e Totals: 4-10A, B, C 3.886 1.097 e Totals: 23,683 101,802 3	Input Filter	4-3A, B, C	0.417	0.057	0.231
4-5A, B, C 2.669 0.178 4-6A, B, C 7.059 1.427 4-7A, B, C 11.280 1.967 5 Misc. Parts 4-7A, B, C 3.176 0.769 6 Misc. Parts 4-9A, B, C 1.843 0.521 e Totals: 4-10A, B, C 3.886 1.097 e Totals: 42.225 9.823 23,683	Power Supply	4-4A, B, C	8.164	2.921	7.093
4-6A, B, C 7.059 1.427 4-7A, B, C 11.280 1.967 5 Misc. Parts 4-9A, B, C 1.843 0.521 6 Misc. Parts 4-10A, B, C 3.886 1.097 e Totals: 42.225 9.823 23,683 (HOURS): 23,683 101,802 3	SRD Multiplier	4-5A, B, C	2.669	0.178	0.780
4-7A, B, C 11.280 1.967 ctric Controller 4-8A, B, C 3.176 0.769 ackage & Misc. Parts 4-9A, B, C 1.843 0.521 ure Rate Totals: 4-10A, B, C 3.886 1.097 MTBF (HOURS): 23,683 101,802 3	Lamp Exciter PBW	4-6A, B, C	7.059	1.427	5.524
ctric Controller 4-8A, B, C 1.843 0.521 ackage & Misc. Parts 4-10A, B, C 3.886 1.097 are Rate Totals: 42.225 9.823 2 MTBF (HOURS): 23,683 101,802 3	RF PWB		11.280	1.967	6.461
arts 4-9A, B, C 1.843 0.521 4-10A, B, C 3.886 1.097 42.225 9.823 2	Serva PWB		3.176	0.769	950.5
4-10A, B, C 3.886 1.097 42.225 9.823 23,683 101,802	Thermoelectric Controller	4-9A, B, C	1.843	0.521	1.363
42.225 9.823	Physica Package & Misc. Parts	4-10A, B, C	3.886	1.097	2.165
23,683 101,802	Failure Rate Totals:		42.225	6.78.6	27.606
	MTBF (HOURS):		23,683	101,802	36,224

3.0 RELIABILITY MATHEMATICAL MODEL

In performing the TRFS reliability prediction a strictly series reliability model was assumed in accordance with paragraph 3.2.3 of Specification 332819. In addition, the standard assumption of constant part failure rates was employed. As a result of these assumptions, the total failure rate of the TRFS is the sum of the failure rates of the TRFS parts, and the TRFS MTBF is simply the reciprocal of the total TRFS failure rate.

4.0 PART LEVEL STRESS AND RELIABILITY DATA

The tables in this section provide a compilation of the detailed part level stress and reliability data which was developed in performing the TRFS reliability prediction. The tables are numbered 4-1 through 4-10 with a set of "A" tables containing the Airborne Uninhabited, Fighter (AUF) @ 2°C data, a set of "B" tables containing the Ground Fixed (GF) € 30°C data and a set of "C" tables containing the Ground Modile (GM) @ 40°C data. forming the prediction, the temperatures entered into the MIL-HDBK-217D failure rate algorithms were the actual local TRFS assembly ambient temperatures and not the overall TRFS cooling air temperature. These local ambients were developed from TRFS thermal studies and measurements performed by E G & G engineering personnel. The assembly ambient temperature which was used for a particular assembly under a specific cooling air condition can be determined by examining the applied junction temperature for a discrete semiconductor with zero power dissipation. Here, the applied junction temperature equals the assembly ambient temperature. For example on Table 4-1A, the applied junction temperature of CRI which is normally non-conducting (zero power dissipation) is seen to be 40°C, and this is the temperature at which the reliability prediction was performed for this assembly, the Pre-Amp PWB, at a TRFS cooling air temperature of 2°C.

An explanation of the information recorded in each column of the tables in this section and the ground rules and/or assumptions pertinent to the derivation of this information is as follows:

COLUMN CONTENTS, GROUND RULES AND/OR ASSUMPTIONS

- 1 REF. SYMBOL: This column contains the reference symbol of each part from the schematic and parts list.
- 2 PART DESCRIPTION: This column provides a narrative description of the part.
- PART NUMBER: This column provides the part number as given on the parts list.
- 4 RATED STRESS: This column lists the manufacturer's rated stress(s) for each part. The listed stresses are as tollows:
 - a. <u>Integrated Circuits:</u> The maximum rated junction temperature;
 - b. Transistors: The maximum rated V_{CEO} , power dissipation and junction temperature;
 - c. <u>Diodes</u>: The maximum rated reverse voltage (except for Zener diodes), the maximum rated average forward current and the maximum rated junction temperature;
 - d. Capacitors: The maximum rated voltage;
 - e. Resistors: The maximum rated power dissipation;
 - f. Magnetics: The maximum insulation temperature.
- 5 APPLIED STRESS: This column provides the applied stress for each part as derived by E G & G engineering personnel. The stresses were tabulated for these parameters enumerated under the foregoing discussion of Column 4.

COLUMN CONTENTS, GROUND RULES AND/OR ASSUMPTIONS

- STRESS RATIO: The computed stress ratios are direct ratios of applied electrical stress to manufacturer's rated stress;
- 7 FAILURE RATE: This column contains the part failure rate in failures per million hours for the TRFS environment and cooling air temperature specified in the top left hand corner of the sheet;
- F.R. SOURCE: This column lists the source of the failure rate listed in column 7 and the key to the contents of this column is as follows:
 - 217D MIL-HDBK-217D (With Notice 1)
 - NOTE 1 Physics Package Rubidium cell failure rate was derived from Rockwell/Global Positioning System information
 - NOTE 2 Heater failure rates were derived from Rockwell data and MINCO life test results
 - NOTE 3 The thermoelectric modules will be non-operational under the prediction conditions.

TABLE 4-1A PRE-AMP PRINTED WIRING BOARD RELIABILITY DATA P/N C316629, REV. C

	e 2°C)					Sheet 1 of	f 2
	PART DESCRIPTION	PART, NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
1C, Li	IC, Linear, Dual Op Amp.	SCD 316786 (0P-14AZ/883B)	125°C	45°C		0.0898	2170
Diode,	Diode, SI, GP	MIL-S-19500/116	75V	۸9	90.0	0.0020	2170
		(JANTXIN4148-1)	500mA	OmM	0.00		
			ე。002	J.04			
Capac	itor, Ceramic, $0.001_{\mu}f$	M39014/5C-2637	100V	٥٨	0.00	0.0087	2170
Capac	Capacitor, Ceramic, 100pF	M39014/5C-2619	100v	36	0.03	0.0067	2170
Capac	Capacitor, Ceramic, 56pf	M39014/5C-2615	1000	24	0.05	0.0063	2170
Capac	Capacitor, Solid, Tantalum, 5.6µf	M39003/01-5043	35V	۸9	0.17	0.2009	2170
Capac	itor, Ceramic, 0.01µf	M39014/5C-2655	200	15V	0.30	0.0223	2170
Capac	ittor, Ceramic, 0.01µf	M39014/5C-2655	20v	157	0.30	0.0223	2170
Capa	Capacitor, Ceramic, 0.01uf	M39014/5C-2655	200	20	0.04	0.0112	2170
Capa	Capacitor, Ceramic, 0.01µf	M39014/5C-2655	200	88	0.16	0.0129	2170
Rest	Resistor, Fixed Film, 18.2KG	RNC50H1822FM	100mM	Jm.	0.01	0.0159	2170
Resi	Resistor, Fixed Film, 13.7kA	RNC50H1372FM	100mW	OmM	0.00	0.0159	2170
Resi	Resistor, Fixed Film, 1002	RNC50H1000FM	100mW	OmM	0.00	0.0159	2170
Resi	Resistor, Fixed Film, 18.2K2	RNC50H1822FM	100mW	Imiv	0.01	0.0159	2170
Resi	Resistor, fixed film, 1002	RNC50H1000FM	100mW	J. T.	0.01	0.0159	2170
Resi	Resistor, Fixed Film, 24.9KB	RNC50H2492FM	100mW	Omin	00.00	0.0159	2170
Resis	Resistor, Fixed Film, 49.9K2	RNC50H4992FM	100mW	3mW	0.03	0.0162	2170
Resis	Resistor, Fixed Film, 20.1KG	RNC50H2012FM	100mW	Zm¥	0.02	0.0161	2170
Resis	Resistor, Fixed Film, 8.25K%	RNC50H8251FM	100mW	Juk	0.01	0.0159	2170
Resis	Resistor, Fixed Film, 10K22	RNC50H1002FM	100mW	Junk	0.01	0.0159	2170
			1				

TABLE 4-IA PRE-AMP PRINTED WIRING BOARD RELIABILITY DATA

_											
f 2	F.R. SOURCE	2170	2170	2170		•					
Sheet 2 of	FAILURE RATE	0.0913	0.2223	0.0718	-	-					
	STRESS RATIO	0.01	70.0							- ·	
,	APPLIED STRESS	5mW	X.								
Rev. C	RATED STRESS	1000mW	M DOT								
2											
	PART NUMBER	RWR81S4R64FM	SCD 316774	C316629PWB							
2°C) P/N C316629,	110n		Terminal (9 @ 0.0247 ECH.) SCD 316774	ded)							
P/N C316629,		RII Resistor, Fixed WW, 4.640	Terminal (9 @ 0.0247 ECH.)	1 Printed Wiring Board (2-sided)							

0.944

1014

TABLE 4-1B PRE-AMP PRINTED WIRING BOARD RELIABILITY DATA

F.R. SOURCE	2170	2170			2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	
FAILURE RATE	9780.0	0.0002			0.0010	0.0007	0.0007	0.0201	0.0025	0.0025	0.0013	0.0014	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	
STRESS RATTO		0.08	0.00		0.00	0.03	0.05	0.17	0.30	0.30	0.04	0.16	0.01	0.00	0.00	0.01	0.01	0.00	0.03	0.05	0.01	0.01	
APPL 1ED STRESS	ე"59	Λ9	Omp	ວ 09	۸٥	36	25	۸9	15V	150	2.0	A8	1mK	ОшМ	MmO	1mW	JmW	OmW	Эт	M≡2	Ne.	JmW	
RATED STRESS	125°C	757	500mA	ე₀02	1000	1000	1000	35V	200	¥05	200	200	100mW	100mW	100mW	100mW	100mW	100mW	100mW	100mW	100mW	100mW	
PART, NUMBER	SCD 316786 (0P-14AZ/883B)	MIL-S-19500/116	(JANTX1N4148-1)		M39014/5C-2637	M39014/5C-2619	M39014/5C-2615	M39003/01-5043	M39014/5C-2655	M39014/5C-2655	M39014/5C-2655	M39014/5C-2655	RNC50H1822FM	RNC50H1372FM	RNC50H1000FM	RNC50H1822FM	RNC50H1000FM	RNC50H2492FM	RNC50H4992FM	RNC50H2012FM	RNC50H8251FM	RNC50H1002FM	
PART DESCRIPTION	IC, Linear, Dual Op Amp.	Diode, SI, GP			Capacitor, Ceramic, 0.001 μ f	Capacitor, Ceramic, 100pf	Capacitor, Ceramic, 56pf	Capacitor, Solid, Tantalum, 5.6µf	Capacitor, Ceramic, 0.01uf	Capacitor, Ceramic, 0.01µf	Capacitor, Ceramic, 0.01uf	Capacitor, Ceramic, 0.01µf	Resistor, Fixed Film, 18.2KG	Resistor, Fixed Film, 13.7kA	Resistor, Fixed Film, 1000	Resistor, Fixed Film, 18.2KD	Resistor, Fixed Film, 1000	Resistor, Fixed Film, 24.9KD	Resistor, Fixed Film, 49.9KD	Resistor, Fixed Film, 20.1KW	Resistor, Fixed Film, 8.25KW	Resistor, Fixed Film, 10KD	
REF SYMBOL	ın.	CR1			5	C2	ខ	2	53	93	- 23	83	R.	RZ	R3	R4	RS	R6	R.7	R8	R9	R10	
	REF PART DESCRIPTION PART, NUMBER STRESS STRESS FALLURE RATE	PART DESCRIPTION PART, NUMBER RATED AFPLIED SIRESS FAILURE IC, Linear, Dual Op Amp. SCO 316786 (OP-14AZ/883B) 125°C 65°C 0.0826	REF PART DESCRIPTION PART. NUMBER RATED STRESS AFPLIED STRESS FALLURE RATE U1 IC, Linear, Dual Op Amp. \$CD 316786 (OP-14AZ/8838) 125°C 65°C 0.0826 CR1 Diode, SI, GP MIL-5-19500/116 75V 6V 0.08 0.0002	REF PART DESCRIFTION PART. NUMBER RATED STRESS STRESS FAILURE RATE SYMBOI 1C. Linear, Dual Op Amp. SCD 316786 (OP-14AZ/883B) 125°C 65°C 0.0826 CRI Diode, SI, GP MIL-5-19500/116 75V 6V 0.08 0.0002 CRI Diode, SI, GP MIL-5-19500/116 500mA 0mM 0.00 0.00	REF PART DESCRIPTION PART. NUMBER RATED STRESS STRESS STRESS FALLURE RATE RATIO U1 IC, Linear, Dual Op Amp. SCD 316786 (OP-14AZ/883B) 125°C 65°C 65°C 0.0082 0.0826 CR1 Diode, SI, GP (JANTXIN4148-1) MIL-5-19500/116 500mA 0mM 0.00 0.00	REF PART DESCRIFTION PART. NUMBER RATED STRESS FAILURE SYMBOI 12, Linear, Dual Op Amp. SCO 316786 (OP-14AZ/883B) 125°C 65°C 65°C 0.0826 CRI Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CI Capacitor, Ceramic, 0.001µf M39014/5C-2637 100V 0V 0.00 0.0010	REF PART DESCRIPTION PART. NUMBER RATED STRESS STRESS FAILURE RATE SYMBOI 1C. Linear, Dual Op Amp. SCO 316786 (OP-14AZ/883B) 125°C 65°C 0.0826 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 500mA 0.00 0.00 0.0002 CI Capacitor, Ceramic, 0.001µf M39014/5C-2637 100V 0V 0.00 0.0007 C2 Capacitor, Ceramic, 100pf M39014/5C-2619 100V 3V 0.03 0.0007	REF PART DESCRIPTIOR FART. NUMBER RATED STRESS STRESS FAPT. URB U1 IC, Linear, Dual Op Amp. SCD 316786 (OP-14AZ/883B) 125°C 65°C 0.0826 CR1 Diode, SI, GP MIL-5-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-5-19500/116 75V 6V 0.08 0.0002 CR1 Capacitor, Ceramic, 0.001µf M39014/5C-2637 100V 0V 0.00 0.000 C2 Capacitor, Ceramic, 100pf M39014/5C-2619 100V 3V 0.05 0.0007 C3 Capacitor, Ceramic, 100pf M39014/5C-2615 100V 5V 0.05 0.0007	REF PART DESCRIFTIOR FART. NUMBER RATED APPLIED SIRESS FAILURF U1 I.C. Linear, Dual Op Amp. SCD 316786 (OP-14AZ/8838) 125°C 65°C 65°C 0.0826 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Capacitor, Ceramic, 0.001µf M39014/5C-2637 100V 0V 0.00 0.0010 C2 Capacitor, Ceramic, 100pf M39014/5C-2619 100V 3V 0.03 0.0007 C3 Capacitor, Ceramic, 56pf M39014/5C-2619 100V 5V 0.05 0.0007 C4 Capacitor, Solid, Tantalum, 5.6µf M39003/01-5043 35V 6V 0.17 0.0201	REF SYMBOIL PART DESCRIFTIOR PART. NUMBER RATED STRESS APPLIED STRESS STRESS RATIO FAILURF RATED U1 I.C. Linear, Dual Op Amp. SCO 316786 (OP-14AZ/883B) 125°C 65°C 0.0826 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CI Capacitor, Ceramic, O.001µf M39014/5C-2637 100V 3V 0.00 0.0010 C2 Capacitor, Ceramic, 56pf M39014/5C-2615 100V 5V 0.05 0.0007 C3 Capacitor, Ceramic, 56pf M39014/5C-2615 100V 5V 0.05 0.0007 C4 Capacitor, Ceramic, 56pf M39014/5C-2615 50V 6V 0.05 0.0007 C5 Capacitor, Ceramic, 0.01uf M39014/5C-2655 50V 15V 0.30 0.0007	REF PART DESCRIFTIOR PART. NUMBER RATED STRESS STRESS STRESS STRESS STRESS FAJIURE RATED RATED RATED STOWN STRESS FAJIURE RATED RATED RATED STOWN ST	REF PARI DESCRIFTIOR FARI. NUMBER RATED AFPLIED SIRESS FAILURE U1 I.C. Linear, Dual Op Amp. SCD 316786 125°C 65°C MILS 0.0826 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Capacitor, Ceramic, O.001µf M39014/5C-2637 100V 0V 0.00 0.0010 C2 Capacitor, Ceramic, 100pf M39014/5C-2615 100V 3V 0.03 0.0007 C3 Capacitor, Ceramic, 56pf M39014/5C-2615 100V 5V 0.05 0.0007 C4 Capacitor, Ceramic, 0.01uf M39014/5C-2615 50V 15V 0.30 0.0007 C5 Capacitor, Ceramic, 0.01uf M39014/5C-2655 50V 15V 0.04 0.001 C6 Capacitor, Ceramic, 0.01uf M39014/5C-2655 50V 2V 0.04 0.001	REF PART DESCRIPTION FART. NUMBER RATED APPY IED SIRESS FAILURE U1 IC, Linear, Dual Op Amp. SCD 316786 125°C 65°C 0.0826 0.0826 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Capacitor, Ceramic, 0.001µf M39014/5C-2637 100V 3V 0.03 0.0007 C2 Capacitor, Ceramic, 100pf M39014/5C-2615 100V 3V 0.05 0.0007 C3 Capacitor, Ceramic, 0.01uf M39014/5C-2615 50V 15V 0.17 0.0201 C4 Capacitor, Ceramic, 0.01uf M39014/5C-2655 50V 15V 0.30 0.0025 C5 Capacitor, Ceramic, 0.01uf M39014/5C-2655 50V 15V 0.04 0.005 C6 Capacitor,	REF PART DESCRIPTION FART. NUMBER RATED APPLIED SIRESS FALLURE U1 I.C. Linear, Dual Op Amp. SCD 316786 125°C 65°C 0.0826 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 500mA 0mM 0.00 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 500mA 0mM 0.00 0.0002 CR1 Capacitor, Ceramic, 100pf M39014/5C-2637 100V 0V 0.00 0.0010 C2 Capacitor, Ceramic, 100pf M39014/5C-2615 100V 3V 0.05 0.0007 C3 Capacitor, Ceramic, 100pf M39014/5C-2615 100V 5V 0.05 0.0007 C4 Capacitor, Ceramic, 0.01uf M39014/5C-2615 50V 0.30 0.0025 C5 Capacitor, Ceramic, 0.01uf M39014/5C-2655 50V 0.04 0.004 C6 Capacitor, Fixed Film, 18.2Kg M39014/5C-2655	RIF SYMEON PARI DESCRIPTION FARI. NUMBER RAIED SIRESS SIRESS SIRESS FAILUBE RAITO U1 I.C. Linear. Dual Op Amp. SCD 316786 (OP-14AZ/883B) 125°C 65°C 0.0826 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.0B 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.0B 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.0B 0.0002 CR1 Capacitor, Ceramic, O.00luf M39014/5C-2637 100V 0V 0.00 0.0010 C3 Capacitor, Ceramic, 100pf M39014/5C-2615 100V 3V 0.03 0.0007 C4 Capacitor, Ceramic, 56pf M39014/5C-2615 100V 5V 0.05 0.0007 C5 Capacitor, Ceramic, 0.0luf M39014/5C-2615 50V 15V 0.30 0.0025 C6 Capacitor, Ceramic, 0.0luf M39014/5C-2615 50V 15V 0.30 0.004 C6 Capacitor, Ceramic,	REFINATION PART. NUMBER RAIESS SIRESS SIRES	Rff PART DESCRIPTION FART. NUMBER SIRESS SIRESS SIRESS FAILURE UI I.C. Linear, Dual Op Amp. SCD 316786 (00-14AZ/883B) 125°C 65°C 0.0826 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Capacitor, Ceramic, 0.00lpf M39014/5C-2637 100V 0V 0.00 0.0007 C2 Capacitor, Ceramic, 0.00lpf M39014/5C-2615 100V 3V 0.03 0.0007 C3 Capacitor, Ceramic, 0.01lpf M39014/5C-2615 50V 15V 0.05 0.0007 C4 Capacitor, Ceramic, 0.01lpf M39014/5C-2655 50V 15V 0.04 0.0017 C5 Capacitor, Ceramic, 0.01lpf M39014/5C-2655 50V 15V 0.04 0.0017 C6 Capacitor, Cer	Rff FART DESCRIPTION FART. NUMBER STRESS SIRESS STRESS STRESS	Rff PART DESCRIPTION PART. NUMBER RATED SIRESS STRESS FATIURE SIRESS FATIURE RATE STRESS FATIURE RATE U1 IC. Linear, Dual Op Amp. SCD 316786 125°C 65°C 0.0826 0.0826 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.00 0.0002 CR1 Capacitor, Ceramic, 0.001µf MISO14/5C-2637 100V 3V 0.003 0.0007 CG Capacitor, Ceramic, 0.01µf MISO14/5C-2635 50V 15V 0.017 0.0002 CG Capacitor, Ceramic, 0.01µf MISO14/5C-2655 50V 15V 0.00 0.0002 CG Capacitor, Ceramic, 0.01µf MISO14/5C-2655 50V 15V 0.04 0.00	RIFT PART DESCRIPTION PART. NUMBER RATED STRESS STRESS FABILURE STRIESS FABILURE UII I.C. Linear. Dual Op Amp. SCO 316786 125°C 65°C 0.0826 0.0826 CRI Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CRI Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CI Capacitor, Ceramic, 100pF M39014/5C-2637 100V 0V 0.00 0.0010 C2 Capacitor, Ceramic, 100pF M39014/5C-2615 100V 3V 0.00 0.0007 C3 Capacitor, Ceramic, 100pF M39014/5C-2615 100V SV 0.00 0.0007 C3 Capacitor, Ceramic, 0.01bf M39014/5C-2615 50V SV 0.00 0.0007 C5 Capacitor, Ceramic, 0.01bf M39014/5C-2655 50V SV 0.00 0.0007 C6 Capacitor, Ceramic, 0.01bf M39014/5C-2655 50V SV 0.00 0.0007	RFF (A) FART DESCRIPTION PART NUMBER STRESS STRESS FARITOR FRAIT U1 I.C. Linear, Dual Op Amp. SCO 316786 125°C 65°C 0.0826 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, SI, GP MIL-S-19500/116 75V 6V 0.08 0.0002 C2 Capacitor, Ceramic, DiOpf MIJOSO14/5C-2637 100V 0V 0.00 0.0010 C2 Capacitor, Ceramic, DiOpf MIJOSO14/5C-2615 100V 3V 0.03 0.0007 C3 Capacitor, Ceramic, DiOpf MIJOSO14/5C-2615 100V 3V 0.05 0.0007 C4 Capacitor, Ceramic, O.Oluf MIJOSO14/5C-2615 100V 3V 0.05 0.0007 C5 Capacitor, Ceramic, O.Oluf MIJOSO14/5C-2615 50V 15V 0.00 0.0007 C6 Capacitor, Ceramic, O.Oluf MIJOSO14/5C-2615 50V 15V 0.00 0.0007 C5 Capacitor, C	RFIT FART DESCRIPTION PART. NUMBER SAIESS SAIESS FABIL VII I.C. Linear, Dual Op Amp. SCD 316786 125°C 65°C 0.0826 CRI Diode, SI, GP HIL-S-19500/116 75V 6V 0.08 0.0002 CRI Diode, SI, GP HIL-S-19500/116 75V 6V 0.08 0.0002 CI Capacitor, Ceramic, O.001µf H39014/5C-2637 100V 3V 0.00 0.0010 C2 Capacitor, Ceramic, 100pf H39014/5C-2619 100V 3V 0.00 0.0007 C3 Capacitor, Ceramic, 0.01µf H39014/5C-2619 100V 3V 0.00 0.0007 C4 Capacitor, Ceramic, 0.01µf H39014/5C-2615 100V 3V 0.05 0.0007 C5 Capacitor, Ceramic, 0.01µf H39014/5C-2615 50V 15V 0.05 0.0007 C6 Capacitor, Ceramic, 0.01µf H39014/5C-2615 50V 15V 0.00 0.0007 C7 Capacitor, Ceramic, 0.01µf H39	HIT IC. Linear. Dual Op Amp. SCO 316786 FARIT DESCRIPTIOR PART. NUMBER RAPIED SIRESS SIRESS SIRESS FABILOB U1 IC. Linear. Dual Op Amp. SCO 316786 129°C 65°C 0.0826 CR1 Diode, S1, GP MIL-S-19500/116 75V 6V 0.08 0.0002 CR1 Diode, S1, GP MIL-S-19500/116 35V 6V 0.08 0.0002 C1 Capacitor, Ceramic, 100pf M19014/5C-2613 100V 0V 0.00 0.0007 C2 Capacitor, Ceramic, 100pf M19014/5C-2615 100V 3V 0.00 0.0007 C3 Capacitor, Ceramic, 0.01bf M19014/5C-2615 100V 3V 0.00 0.0007 C4 Capacitor, Ceramic, 0.01bf M19014/5C-2655 50V 5V 0.00 0.0007 C5 Capacitor, Ceramic, 0.01bf M19014/5C-2655 50V 5V 0.00 0.0007 C6 Capacitor, Ceramic, 0.01bf M19014/5C-2655 50V 2V 0.00 0.0007

TABLE 4-1B PRE-AMP PRINTED WIRING BOARD RELIABILITY DATA

F.R. Source	2170 2170 2170 2170
FAILURE RATE	0.0079 0.0023 0.0495 0.0047
STRESS RATIO	0.01
APPLIFD STRESS	SmW SmW
RATED STRESS	100mW
PART, NUMBER	RWRB1S4R64FM RNC50H3012FM SCD 316774 C316629PWB
PART DESCRIPTION	Resistor, Fixed WW, 4.64 R Resistor, Fixed Film, 30.1K R Terminal (9 @ 0.0055 ECH.) Printed Wiring Board (2-sided)
RE F SYMBOL	R11 R12 E1 PWB1
	PART DESCRIPTION PART, NUMBER STRESS FALLURE STRESS RATIO RATE

002.0

B-16

TABLE 4-1C PRE-AMP PRINTED WIRING BOARD RELIABILITY DATA

of 2	F.R. SOURCE	2170	2170			2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	
Sheet 1 o	FAILURE RATE	0.1205	0.0012			0.0048	0.0037	0.0035	C. C704	0.0124	0.0124	0.0062	0.0071	0.0677	0.0077	0.0077	0.0077	0.0077	C.0077	0.0079	0.0078	0.0077	0.0077	
	STRESS RATIO		0.08	0.00		0.00	0.03	0.05	0.17	0.30	0.30	0.04	0.16	0.01	00.00	00.00	0.01	0.01	00.00	0.03	0.02	0.01	0.01	
,	APPL 1ED STRESS	2.02	۸9	OmM	ງ•39	8	30	20	۸9	15V	15V	5۸	88	J.m.M	OmM	OmW	1mW	Jmk	Omik	3mW	Sm¥	Mm1	JmM	
EV. C	RATED STRESS	125°C	75V	500mA	200℃	1000	100V	1000	35V	50V	507	200	200	100mW	100mW	100™	100mW	100mW	100mW	100mW	100mW	100mW	100mW	
P/N C316629, REV. C	PART AUMBER	SCD 316786 (0P-14AZ/8838)	MIL-S-19500/116	(JANTX1N4148-1)		M39014/5C-2637	M39014/5C-2619	M39014/5C-2615	M39003/01-5043	M39014/5C-2655	M39014/5C-2655	M39014/5C-2655	M39014/5C-2655	RNC50H1822FM	RNC50H1372FM	RNC50H1000FM	RNC50H1822FM	RNC50H1000FM	RNC50H2492FM	RNC50H4992FM	RNC50H2012FM	RNC50H8251FM	RNC50H1002FM	
40°C)	PART DESCRIPTION	IC, Linear, Dual Op Amp.	Diode, SI, GP			Capacitor, Ceramic, 0.001µf	Capacitor, Ceramic, 100pF	Capacitor, Ceramic, 56pf	Capacitor, Solid, Tantalum, 5.6uf	Capacitor, Ceramíc, 0.01µf	Capacitor, Ceramic, 0.01µf	Capacitor, Ceramic, 0.01µf	Capacitor, Ceramic, 0.01uf	Resistor, Fixed Film, 18.2松	Resistor, Fixed Film, 13.7 $k\Omega$	Resistor, Fixed Film, 1002	Resistor, Fixed Film, 18.2K Ω	Resistor, Fixed Film, 1000	Resistor, Fixed Film, 24.9KΩ	Resistor, Fixed Film, 49.9K Ω	Resistor, fixed film, $20.1 \mathrm{K}a$	Resistor, fixed Film, 8.25KW	Resistor, Fixed Film, 10KΩ	
(G:1 @ 40	REF SYMBOL	U1	CRI			3	23	3	52	53	93	7.2	83	83	R2	R3	84	R5	R6	R7	88	R9	R10	
•	96097 · 8	1678								_	-17													

TABLE 4-1C

PRE-AMP PRINTED WIRING BOARD RELIABILITY DATA

ĺ		
f 2	F.R. SOURCE	2170 2170 2170 2170
Sheet 2 of		0.0456 0.0078 0.1710 0.0158
	STRESS RATIO	0.02
	APPLIED STRESS	SmW
Rev. C	RATED STRESS	1000mW 100mW
P/N C316629, Re	PART NUMBER	RWR8154P64FM RNC50H3012FM SCD 316774 C316629PWB
را 40°2)	PART DESCRIPTION	Resistor, Fixed WW, 4.64 Resistor, Fixed Film, 30.1K Terminal (9 @ 0.0190 ELH) Printed Wiring Board (2-sided)
(C: e)	REF SYMBOL	R11 R12 E1 PWB1
·	+#O+V - 8	kararan <u>ana ang mangangan ang mangan</u> an ang mangangan ang mangangan ang mangangan ang mangangan ang mangangan ang

TOTAL

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TABLE 4-2A

VCXO PRINTED WIRING BOARD RELIABILITY DATA

P/N C314314, REV.

•	(AUF	(6 2°C)					Sheet 1 of	f 2
+00++-	REF SYMBOL	PART DESCRIPTION	FART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAILURE RATE	. F .R. SOURCE
91678	Ul	IC, Linear, Quad Xistor Array	SCD 316785	450mW	34mW	0.08	0.4770	2170
				125°C	ວູ08			
	CR1	Diode, SI, Varactor	M1L-S-19500/436	300	100	0.33	1.2770	2170
			(JANTXINS474B	400mM	Omik	0.00		
				175°C	ງ ູ08			
	C	Capacitor, Ceramic Chip, 0.01uf	882918 028	500	100	0.20	0.0160	2170
			(200A103KP50)					
	23	Capacitor, Ceramic Chip, 0.01µf	SCD 316788	200	100	0.20	0.0160	2170
			(200A103KP50)					
Ω	C3	Capacitor, Ceramic Chip, 150pF	COR128P151AJSM	200	۸0	0.00	0.0078	2170
-19	5	Capacitor, Ceramic Chip, 0.001µf	SCD 316788	200	λς	0.10	0.0099	2170
_			(200A102KP50)					
_	C5	Capacitor, Ceramic Chip, Select	COR12BPXXXAJSM	200	100	0.20	0.0089	2170
	9)	Capacitor, Ceramic Chip, 47pF	CDR128P470AJSM	200	1,	0.02	0.0068	2170
	73	Capacitor, Ceramic Chip, 180pF	CDR12BP181AJSM	200	۸0	0.00	0.0079	2170
	83	Capacitor, Ceramic Chip, Select	CDR128PXXXAJSM	500	100	0.20	0.0039	2170
	63	Capacitor, Ceramic Chip, 0.1µf	SCD 316788	500	24	0.10	0.0165	2170
	-		(200B104KP50X)					
	C10	Capacitor, Ceramic Chip, 0.01µf	SCD 316788	200	100	0.20	0.0160	2170
			(200A103KP50)					
	R.3	Resistor, Fixed Film Chip, 1002	M55342/4-M101GRM	330mW	2mW	0.01	0.0226	2170
	R2	Resistor, Fixed Film Chip, 10KD	M55342/4-M103GRM	330mW	3mW	0.01	0.0226	2170
	. –							

KKKKKKT DSKKKSKT PPPZEKKT RACKKKKT PKKKKKSKT DSKKKKÅ

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TABLE 4-2A

VCXO PRINTED WIRING BOARD RELIABILITY DATA

•	(AUF	6 2°C)	P/N C314314, REV	٠٧.		S	Sheet 2 of	2
+60+4	REF SYMBOL	PART DESCRIPTION	PART_NUMBER	RATED STRESS	APPLIED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
1676	R3	Resistor, Fixed Film Chip, 22Kg	M55342/4-M223GRM	330mW	JmW	0.00	0.0226	2170
	84	Resistor, Fixed Film Chip, 47KQ	M55342/4-M473GRM	330mW	Je I	00.00	0.0226	2170
	RS	Resistor, Fixed Film Chip, 47K2	M55342/4-M473GRM	330mW	Juk	0.00	0.0226	2170
	R6	Resistor, Fixed Film Chip, 1000	M55342/4-M101GRM	330mW	MmO	0.00	0.0226	2170
	R7	Resistor, Fixed Film Chip, 100KA	M55342/4-M104GRM	330mW	MEO	0.00	0.0226	2170
	R8	Resistor, Fixed Film Chip, 100KΩ	M55342/4-M104GRM	330mW	Amo	0.00	0.0226	2170
	R9	Resistor, Fixed Film Chip, 150	M55342/4-M15RGRM	330mW	OmM	0.00	0.0226	2170
	R10	Resistor, fixed Film Chip, 1KA	M55342/4-M102GRM	330mW	4m¥	0.01	0.0226	2170
	<u>.</u>	Inductor	T-25-6 Core	105°C	ວູ08		0.0429	2170
B- 20	77	Inductor	SCD 316771	105°C	ე_08		0.0429	2170
1			,					
	=	Transformer	T-25-6 Core	105°ເ	ე.08		0.0764	2170
	ī	Crystal, 10MHz	2830027				0.2000	2170
	E1	Terminals (9 @ 0.0247 ECH)	SCD 316774				0.2223	2170
	PW81	Printed Wiring 8d.(2-sided)	C314314 PWB				0.1076	2170
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TABLE 4-2B VCXO PRINTED WIRING BOARD RELIABILITY DATA

*60** - 81678

f 2	F.R. SOURCE	2170		2170			2170		2170		2170	2170		2170	2170	2170	2170	2170		2170		2170	2170	
Sheet 1 of	FAIL URE RATE	0.2440	-	0.0711			0.0017		0.0017		0.0008	0.0011	•	0.00.0	0.0007	0.0008	0.0009	0.0018		0.6017		6.0027	0.0027	
	STRESS RATIO	0.08		0.33	0.00		0.20		0.20		00.0	0.10		0.20	0.05	00.0	07.50	0.10		0.20		0.01	0.01	
	APPL IED STRESS	34mW	ວູ08	100	MmO	ວູ08	100		100		۸	24		100	٦٨	۸0	100	20		100		2mM	3mM	1
٠.	RATED STRESS	450mW	125°C	300	400mH	175°C	200		20v		200	200		200	200	20v	500	500		200		330mW	330mW	
P/N C314314, REV.	PART NUMBER	SC0 316785		MIL-S-19500/436	(JANTXIN5474B		SCD 316788	(200A103KP50)	SCD 316788	(200A103KP50)	CDR12BP151AJSM	SCD 316788	(200A102KP50)	CDR12BPXXXAJSM	CDR12BP470AJSM	CDR12BP181AJSM	CDR12BPXXXAJSM	SCD 316788	(200B104KP50X)	SCD 316788	(200A103KP50)	M55342/4-M101GRM	M55342/4-M103GRM	
30°C)	PART DESCRIPTION	IC. Linear, Quad Xistor Array		Diode, SI, Varactor			Capacitor, Ceramic Chip, 0.01µf		Capacitor, Ceramic Chip, 0.01µf		Capacitor, Ceramic Chip, 150pf	Capacitor, Ceramic Chip, 0.001µf		Capacitor, Ceramic Chip, Select	Capacitor, Ceramic Chip, 47pF	Capacitor, Ceramic Chip, 180pf	Capacitor, Ceramic Chip, Select	Capacitor, Ceramic Chip, 0.1µf		Capacitor, Ceramic Chip, $0.01_{\rm H}$ f		Resistor, fixed film Chip, 100.	Resistor, Fixed Film Chip, 10Kg	
(GF & 30	REF SYMROL	r,		CR.)			5		C2			2		55	93	22	83	60		010		R.I	R2	

TABLE 4-2B

VCXO PRINTED WIRING BOARD RELIABILITY DATA

(GF (6 35 °C) REF CYMBOIL	PART DESCRIPTION	P/N C314314, RE	REV.	APPL JED	Į.	Sheet 2 of	2
			STRESS	STRESS	RATIO	RATE	SOURCE
Resistor, Fixed Film Chip, 22K a	ip, 22Ka	M55342/4-M223GRM	330nW	MEI	0.00	0.0627	2170
Resistor, fixed Film Chip, 47KQ	, 47KL	M55342/4-M473GRM	330mW	重	00.0	0.0027	2170
Resistor, Fixed Film Chip, 47KQ	. 47Ku	M55342/4-M473GRM	330mW	1mW	00.00	0.0027	2170
Resistor, Fixed Film Chip	Chip, 1000	M55342/4-M101GRM	330mW	OmM	00.00	0.0027	2170
Resistor, Fixed Film Chip,	Сհքр, 100КΩ	M55342/4-M104GRM	330mW	MmO	00.0	0.0027	2170
Resistor, Fixed Film Chip,	Chip, 100KG	M55342/4-M104GRM	330mW	MmO	00.00	0.0027	2170
Resistor, Fixed Film Chip, 150	150	M55342/4-M15RGRM	330mW	Omit	0.00	0.0027	2170
Resistor, Fixed Film Chip, 1KA	1Kn	M55342/4-M102GRM	330mW	4mM	0.01	0.0027	2170
Inductor		1-25-6 Core	ე。901	ວ.08		0.0155	2170
Inductor		1229 316771	105°C	ວູ08		0.0155	2170
Transformer		1-25-6 Core	105°C	80°C		0.0436	0712
Crystal, 10MHz		2830027				0.2000	2170
Terminals (9 @ 0.0055 ECH)		SCD 316774				0.0495	2170
		and Arcarca				. 700	c c
Printed Wiring Bd.(Z-sided)		C314314 PWB				0.00/1	2170
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TABLE 4-2C VCXO PRINTED WIRING BOARD RELIABILITY DATA

f 2	F.R. Source	2170		2170			2170		2170		2170	2170		2170	2170	2170	2170	2170		2170		2170	2170		
Sheet 1 of	FAILURE RATE	0.3050		0.3284			0.0083		6.000.0		0.0040	0.0052		0.0046	0.0036	0.0041	0.0046	0.0086		0.0083		0.0088	0.0088		
	STRESS RATIO	0.08		0.33	0.00		0.20		0.20		0.00	0.10		0.20	0.02	0.00	0.20	0.10		0.20		0.01	0.01		
	APPL 1ED STRESS	34mW	ວ _° 08	100	Am O	ວູ08	100		100		٥	20		100	10	Λ0	100	5٧		100		2mW	3mM		
. >	RATED STRESS	450mW	125°C	300	400mW	175°C	200		500		200	200		500	200	200	200	500		50V		330mW	330mW		
P/N C314314, REV.	PART NUMBER	SCD 316785		MIL-S-19500/436	(JANTXIN5474B		SCD 316788	(200A103KP50)	SCD 316788	(200A103KP50)	CDR128P151AJSM	SCD 316788	(200A102KP50)	CDR12BPXXXAJSM	CDR12BP470AJSM	CDR128P181AJSM	CDR12BPXXXAJSM	SCO 316788	(200B104KP50X)	SCD 316788	(200A103KP50)	M55342/4-M101GRM	M55342/4-M103GRM		
40°C)	PART DESCRIPTION	IC, Linear, Quad Xistor Array		Diode, SI, Varactor			Capacitor, Ceramic Chip, 0.01uf		Capacitor, Ceramic Chip, $0.01\mu f$		Capacitor, Ceramic Chip, 150pF	Capacitor, Ceramic Chip, 0.001µf		Capacitor, Ceramic Chip, Select	Capacitor, Ceramic Chip, 47pF	Capacitor, Ceramic Chip, 180pf	Capacitor, Ceramic Chip, Select	Capacitor, Ceramic Chip, 0.1µf		Capacitor, Ceramic Chip, 0.01 μ f		Resistor, Fixed Film Chip, 1002	Resistor, fixed film Chip, 10K2		
(GM & 4	REF SYMBOL	In		E			5		23		<u>ເ</u>	\$		S	93	C2	83	63		C10		2	R2	 	

TABLE 4-2C VCXO PRINTED WIRING BOARD RELIABILITY DATA

	.	RATED	APPLIED		Sheet 2 of	7
PART DESCRIPTION	PART NUMBER	STRESS	518155	KA110	RATI	SOURCE
Resistor, fixed film Chip, 22K4	i M55347/4-M223GRM	330mW	low	0.00	0,0048	2170
Resistor, fixed Film Chip, 47KG	. M55342/4-M473GRM	330mW	Me I	00.0	6,0058	2170
Resistor, Fixed Film Chip, 47Kg	A M55342/4-M473GRM	33000	Iniv	0.00	c, 00.655	2170
Resistor, Fixed Film Chip, 1000	.1 M55342/4-M101GPM	330mW	(Ant)	0.95	0.0988	2170
Resistor, Fixed Film Chip, 100KΩ	KO M55342/4-M104GRM	330AnW	76 (A)	0.00	0.0068	2170
Resistor, fixed film Chip, 100KG	CO M55342/4-M104GRM	33(xnW	Omiv	00.00	0.0088	2170
Resistor, Fixed Film Chip, 150	M55342/4-M15RGRM	330ни	OmW	00 0	0.00%8	2170
Resistor, Fixed Film Chip, 1KG	M55342/4-M102GRM	330mW	4m¥	0.01	0.0088	2170
Inductor	1-25-6 Core	J. 501	ე,08		0.0515	2170
Inductor	SC0 316771	ງ ,501	ວູ08		0.0515	2170
	2 3 JC 1	70 301	J ₀ 00		2180 0	116
11151011111	2000-0-0-1	o Car	3 00			6170
Crystal, 10MHz	2830027				0.2000	2170
Terminals (9 0 U.0190 LCH)	SC0 316774				0.1/10	2170
Printed Wiring Bd.(?-sided)	C314314 PWB				0.0737	2170
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TABLE 4-3A INPUT FILTER RELIABILITY DATA

f 1	L.R. SOURCE	2170			2170			2170		2170		2170	2170	2170	2170	
Sheet 1 of	FAILURE RATE	0.0039		0 0001	0.003/			0.0189		0.1205		0.0641	0.0041	0.0042	0.1976	
	STRESS RATIO	0.00	0.10	,	0.00	0.08		00.00		0.35		0.07				
	APPL 1ED STRFSS	00	0.3A	30°C	8	0.44	32°C	35	20°C	26V		287	22°C	25°C		
REV.	RATED STRESS	1001	34	175°C	800	5A	175°C	34	175°C	757		200V	105°C	305°€		
P/N 8314338 RE	PART, NUMBER	M11-5-19500/477	(JANTX1N5809)		MIL-S-19500/420	(JANTX1N5553)		MIL-S-19500/434	(JANTX1N5613)	MIL-C-39006/4364		MIL-C-39006/1379	1408PA315-368	1408PA315-368	SC0 316774	
6 2°C)	PART DESCRIPTION	Diode, SI, Rectifier			Diode, SI, Rectifier			Diode, SI, Power Zener		Capacitor, Tantalum, Non-solid,	33µf	Capacitor, Tantalum, Non-solid,	Spr Inductor: 2.4mH	Inductor, 2.4mH	Terminal (8 @ 0.0247 ECH)	
(AUF	REF SYMROL	CR1			CR2			CR3		:		C2	=	12		

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TABLE 4-3B
INPUT FILTER RELIABILITY DATA

ſ																· · · ·	·	 	
of 1	L.R. SOURCE	2170			2170			2170		2170	2170		2170	2170	2170				
Sheet 1 c	FATLURE PATE	9000.0			0.0005			0.0014		0.0045	0.6024		0.0018	0.0019	0.0440				
	STRESS RATIO	00.0	0.10		0.00	0.08		00.0		0.35	0.07								
	APPLIED STRESS	λ0	0.3A	ე_85	00	0.4A	ე。69	36	18° Ը	26v	287		່	23°C					
:V.	RATED STRESS	1000	3A	175°C	800v	5.A	175°C	ME	175°C	75V	2007		105°C	105°C					
P/N 8314338 REV	PART NUMBER	MIL-S-19500/477	(JANTX1N5809)		MIL-S-19500/420	(JANTX1N5553)		MIL-S-19500/434	(JANTX1N5613)	MIL-C-39006/4364	M1L-C-39006/1379		1408PA315-368	1408PA315-368	SCD 316774				
30°C)	FART DESCRIPTION	Diode, SI, Rectifier			Diode, SI, Rectifier			Diode, SI, Power Zener		Capacitor, Tantalum, Non-solid, 33uf	Capacitor, Tantalum, Non-solid,	5յյք	Inductor, 2.4mH	Inductor, 2.4mH	Terminal (8 @ 0.0055 fCH)				
(GF @ 3	REF SYMBOL	CR1	,		CR2			CR3	-	IJ	23			12	E3				
Ĺ	*60**	1679								В-	2 ti							 	

TOTAL

0.057

TABLE 4-3C INPUT FILTER RELIABILITY DATA

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of 1	F.R. SOURCE	2170	2170	2170	2170	2170	2170	2170
Sheet 1 o	FAILURE RATE	0.0031	u.0029	7900.0	0.0338	0.0179	0.0072	0.1520
	STRESS RATIO	0.00	0.00	00.00	0.35	0.07		
	APPLIED STRESS	0V 0.3A	68°C 0V 0.4A 73°C	ე°8∂ ₩0	26V	28V	ລ _ະ ເອ ລູ09	
REV.	RATED STRESS	100V 3A	175°C 800V 5A 175°C	3W 175°C	75V	200 v	105°C 105°C	
P/N 8314338 RE	PART NUMBER	MIL-S-19500/477 (JANTXIN5809)	MIL-S-19500/420 (JANTX1N5553)	MIL-S-19500/434 (JANTX1N5613)	M1L-C-39006/4364	MIL-C-39006/1379	1408PA315-368 1408PA315-368	SCD 316774
40°C)	PART DESCRIPTION	Diode, S1, Rectifier	Diode, SI, Rectífier	Diode, SI, Power Zener	Capacitor, Tantalum, Non-solid, 33µf	Capacitor, Tantalum, Non-solid,	Inductor, 2.4mH Inductor, 2.4mH	Terminal (8 @ 0.0196 ECH)
(GM 6 4	RE I SYMBOL	CR1	CR2	CR3	73	23	12 22	: 🗉

Wild Belevel Bassass Tossassa Pers

0.231

TOTAL

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TABLE 4-4A

POWER SUPPLY RELIABILITY DATA

125°C 48°C 0.45&C 125°C 125°C 0.1545 125°C 22°C 0.1545 125°C 27°C 0.3919 125°C 27°C 0.3919 125°C 40°C 0.2399 155°C 20°C 0.2399 150°C 20°C 0.1505 150°C 20°C	REF PART DESCRIPTION	PART DESCRI	Ĺ	P/N D314311, R PAPT NUMBER	REV.	APPLIED STRESS	STRESS RATIO	Sheet 1 c	of 6 Source
125°C 22°C 0.1545 125°C 27°C 0.3919 125°C 45°C 0.2399 125°C 46°C 0.2399 125°C 40°C 0.2399 150°C 20°C 0.1505 150°C 30°C 0.1505 200°C 30°C 0.17 200°C 30°C 0.13	IC. Linear, SW. Voltage Regulator	-#		378S40DB (883B)	125°C	48°C	01184	0.4586	21
125°C 51°C 0.476.7 125°C 27°C 0.3919 125°C 46°C 0.2399 125°C 40°C 0.00011 8.33W 0W 0.00 0.1505 150°C 20°C 8.33W 0.17 0.1505 150°C 20°C 8.33W 1.42W 0.17 0.1505 150°C 30°C 30°C 30°C 30°C 30°C 30°C 30°C 3	1C, Linear, Dual Comparator			LM193JG/8838	125°د	22°C		0.1545	2170
125°C 27°C 0.3919 125°C 45°C 0.2399 125°C 40°C 0.00011 8.33W 0W 0.00 0.1505 150°C 20°C 8.33W 1.42W 0.17 0.18%? 150°C 70°C 0.003 150°C 30°C 30°C 30°C 30°C 30°C 30°C 30°C 40V 1V 0.03 800mW 100mW 0.13 200°C 30°C 30°C 40°C 40°C 32°C 40°C 30°C 30°C 30°C 30°C 30°C 30°C 30°C 3	Jator		-N	UA78540DM (883B)	J°521	21°C		0.4787	2170
125°C 46°C 0.2399 125°C 40°C 0.0811 8.33W 0W 0.00 0.1505 150°C 20°C 8.33W 0.17 0.1505 150°C 20°C 8.33W 1.42W 0.17 0.18εε 150°C 70°C 40V 1V 0.03 0.0047 800mW 100mW 0.13 200°C 30°C 30°C 40V 1V 0.03 0.0047 800mW 100mW 0.13 200°C 30°C 30°C 40V 1V 0.03 0.0065	(14 IC, Linear, Sw. Voltage Regulator UA	Itage Regulator	⇒ 	UA785400M (8838)	125°C	27°€		0.3919	2170
125°C 40°C 0.0811 8.33W 0W 0.00 0.1505 150°C 20°C 0.1505 150°C 20°C 0.1505 150°C 20°C 0.1888 1.42W 0.17 0.1888 150°C 70°C 0.0053 600mW 100mW 0.17 0.0053 800mW 100mW 0.13 200°C 30°C 30°C 0.0065 40V 1V 0.03 0.0047 800mW 70mW 0.12	US IC, Linear, Quad OP Amp.		Œ	M38510/110058CB	125°C	45°C		0.2399	2170
125°C 40°C 0.0811 8.33W 0W 0.00 0.1505 150°C 20°C 8.33W 0W 0.00 0.1505 150°C 20°C 8.33W 1.42W 0.17 0.1955 150°C 70°C 40V 1V 0.03 0.0053 600mW 100mW 0.17 800mW 100mW 0.13 200°C 30°C 40V 1V 0.03 6000W 0.13 200°C 30°C 40V 1V 0.03 6000W 0.13 200°C 32°C				(LM124AJ)					
8.33W 0W 0.00 0.1505 150°C 20°C 8.33W 0W 0.00 0.1505 150°C 20°C 8.33W 1.42W 0.17 0.18EE 150°C 70°C 40V 1V 0.03 0.0053 600mW 100mW 0.13 200°C 30°C 40V 1V 0.03 600mW 0.13 200°C 30°C 40V 1V 0.03 200°C 30°C 200°C 30°C 30°C 200°C 30°C 200°C 30°C 200°C 30°C	U6 1C, Linear, Voltage Ref. 10V LH		<u> </u>	LH0070-H/8838	125°C	J.04		0.0811	2170
150°C 20°C 8.33W 0W 0.00 0.1505 150°C 20°C 8.33W 1.42W 0.17 0.18EE 150°C 40V 1V 0.03 0.0053 600mW 100mW 0.13 800mW 0.12 600mW 70mW 0.12 600mW 70mW 0.12	Q1 Transistor, Power FET, N RF	FET, N	RF	RFL4N15/JANTX	8.33W	36	0.00	0.1505	2170
8.33W 0W 0.00 0.1505 150°C 20°C 0.00 0.1505 150°C 70°C 0.17 0.1855 40V 1V 0.03 0.0053 600mW 100mW 0.17 0.0047 30°C 30°C 0.0047 800mW 100mW 0.13 200°C 30°C 0.0047 40V 1V 0.03 0.0065 600mW 70mW 0.12 0.0065					150°C				
150°C 20°C	02 Transistor, Power FET, N RFL	FET, N	RFL	4N15/JANTX	8.33W	M 0	0.00	0.1505	2170
8.33W 1.42W 0.17 0.1855 150°C 70°C 0.003 40V 1V 0.03 0.0053 600mW 100mW 0.17 200°C 30°C 30°C 30V 1V 0.03 0.0047 800mW 100mW 0.13 200°C 30°C 0.0055					150°C	ე₀0			
150°C 70°C 40V 1V 0.03 0.0053 600mW 100mW 0.17 0.03 0.0047 30°C 30°C 30°C 30°C 40V 1V 0.03 0.0047 40V 1V 0.03 0.0065 600mW 70mW 0.12 0.0065	Q3 Transistor, Power FET, N RFL	FET, N	RFL	IN15/JANTX	R.33W	1.42W	0.17	0.1886	2170
40V 1V 0.03 0.0053 600mW 100mW 0.17 0.0053 200°C 30°C 0.0047 800mW 1V 0.03 0.0047 40V 1V 0.03 0.0065 600mW 70mW 0.12 0.0065 200°C 32°C 32°C					150°C	J.02			
600mW 100mW 0.17 200°C 30°C 30V 1V 0.03 800mW 100mW 0.13 200°C 30°C 40V 1V 0.03 600mW 70mW 0.12	Q4 Transistor, SI, PNP MIL		Ĕ	-5-19500/290	4 0v	10	0.03	0.0053	2170
200°C 30°C 30°C 30°C 30°C 30°C 30°C 30°C				JAHTX2N2905)	Мш009	100mW	0.17		
30V 1V 0.03 0.0047 800mW 100mW 0.13 200°C 30°C 40V 1V 0.03 0.0065 600mW 70mW 0.12	-				ე₀002	30°C			
800mW 100mW 0.13 200°C 30°C 40V 1V 0.03 0.0065 600mW 70mW 0.12	Q5 Transistor, SI, NPN MIL-		¥	-S-19500/251	304	1.0	0.03	0.0047	2170
200°C 30°C 40V 1V 0.03 0.0065 600mW 70mW 0.12 200°C 32°C			٠	JANTX2N2219)	800mW	100mW	0.13		
40V 1V 0.03 ().0065 600mW 70mW 0.12 200°C 32°C					J°005	ე。0€			
600mW 70mW 200°C 32°C	Q6 Transistor, S1, PNP MIL		M.	-5-19500/290	407	7.	0.03	0.0065	2170
				JANTX2N2905)	Mm009	7 OmW	0.12		
					ე₀002	32°C			

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POWER SUPPLY RELIABILITY DATA

9 jo	F.R. Source	2170		2170		2170		2170		2170			2170			2170			2170	_	2170		2170			
Sheet 2 o	FAILURE RATE	0.0013		0.0189		0.0189	-	0.0189		0.0673			0.0673			0.0054			0.0235		0.0235		0.0013			
	STRESS RAT10	0.00		0.00		0.00		0.00		90.0	0.30		0.15	.30		0.15	0.20		0.00		0.00		0.02	0.00		
	APPL JED STRESS	36	ე。02	3	ე₀02	3	ე₀0	3	20℃	۸9	0.3A	30°C	150	0.3A	ე₀82	15V	0.2A	3.92	3 6	ე₀0	™	ე₀02	٦,	OmA	20°C	
REV.	RATED STRESS	ME	175°C	38	J,871	WS.0	ວ₀002	M5.0	ე。002	1000	N.	150°C	1000	1A	150°C	1000	14	150°C	MS.0	150°C	MS.0	150℃	500	200mA	175°C	
P/N D314311, R	PART NUMBER	MIL-S-19500/434	(JANTX1N5610)	MIL-S-19500/434	(JANTX1N5610)	1N5257/JANTX		1N5257/JANTX		M1L-S-19500/477	(JANTX1N5804)		MIL-S-19500/477	(JANTX1N5804)		M1L-S-19500/477	(JANTX1N5804)		1N5231/JANTX		1N5231/JANTX		MIL-S-19500/231	(JANTX1N3600)		
0 2°C)	PART DESCRIPTION	Diode, S1, Zener		Diode, SI, Zener		Diode, SI, Zener		Diode, SI, Zener		Diode, SI, Rectifier			Diode, SI, Rectifier			Diode, SI, Rectifier			Diode, SI, Zener		Diode, SI, Zener		Diode, SI, GP			
(AUF	REF SYMBOL	CRI		CR2		CR3		CR4		CR5			CR6			CR7			CR8		CR9		CR10			

TABLE 4-4A POWER SUPPLY RELIABILITY DATA

9	F.R. SOURCE	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170		
Sheet 3 of	FATLURE RATE	0.0119	0.0106	0.0480	0.1026	0.0119	0.0106	0.0480	0.1026	0.2157	0.1357	0.0058	0.0059	0.7881	0.4248	0.4248	0.0093	0.2554	0.0093	0.0093	0.0106	0.0085	0.4036		
S	STRESS RAT10	0.15	00.00	0.36	95.0	0.15	00.0	0.36	0.56	0.34	0.10	0.09	0.01	09.0	0.46	0.46	0.15	0.43	0.15	0.15	0.30	0.10	05.0		
	APPLIED STRESS	15V	۸0	187	287	15V	۸٥	180	287	17.0	۱۲	17V	10	۸9	16V	16V	300	15V	300	300	15V	200	5.4		· · · · · · · · · · · · · · · · · · ·
EV.	RATED STRESS	1000	1000	200	200	1000	1000	200	200	200	100	2000	1000	100	350	35V	2000	35V	2000	2000	\$00 P	2007	100		
P/N D314311, REV.	PART NUMBER	M39014/1C-1455	M39014/1C-1455	M39014/2E-1407	M39014/1C-1473	M39014/1C-1455	M39014/1C-1455	M39014/2E-1407	M39014/1C-1473	M39003/03-0180	M39003/03-0116	M39014/1C-1210	CCPOSCG102JM	M39003/03-0124	M39003/03-0171	M39003/03-0171	M39014/1C-1237	M39003/03-0164	M39014/1C-1237	M39014/1C-1237	M39014/1C-1473	M39014/1C-1237	M39003/03-0118		
9 2°C)	FART DESCRIPTION	Capacitor, Ceramic, 0.01µf	Capacitor, Ceramic, 0.01 of	Capacitor, Ceramic, luf	Capacitor, Ceramic, 0.1µf	Capacitor, Ceramic, 0.01µf	Capacitor, Ceramic, 0.01 _p f	Capacitor, Ceramic, luf	Capacitor, Ceramic, 0.1µf	Capacitor, Solid Tantalum, 6.8µf	Capacitor, Solid Tantalum, 6.8µf	Capacitor, Ceramic, 33pF	Capacitor, Ceramic, 0.001pf	Capacitor, Solid Tantalum, 82µf	Capacitor, Solid Tantalum, 47µf	Capacitor, Solid Tantalum, 47µf	Capacitor, Ceramic, 0.001µf	Capacitor, Solid Tantalum, 1.8µf	Capacitor, Ceramic, 0.001µf	Capacitor, Ceramic, 0.001µf	Capacitor, Ceramic, 0.1uf	Capacitor, Ceramic, 0.001µf	Capacitor, Solid Tantalum, 8.2uf		
(AUF (RF F SYMBOL	Ü	23	<u> </u>	5	53	. 93	C7	83	65	C10	C11	(12	C13	C14	C15	910	C17	618	613	C20	C21	C22		

TABLE 4-4A POWER SUPPLY RELIABILITY DATA

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9 J	F.R. SOURCE	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	
Sheet 4 of	FAILURE RATE	0.2554	0.0119	0.0119	0.0119	0.0119	0.0154	0.0154	0.0150	0.0133	0.0133	0.0170	0.0163	0.0150	0.0133	0.0133	0.0187	0.0163	0.0034	0.0099	0.0133	0.0136	0.0369	0.0056	
Sh			_								_	_	_												
	STRESS RATIO	0.43	0.15	0.15	0.15	0.15	0.15	0.15	0.12	0.01	0.00	0.24	0.20	0.12	0.01	0.00	0.24	0.20	0.32	0.92	0.01	0.03	96.0	09.0	
	APPL 1ED STRESS	15V	15V	15V	15V	15V	15V	157	12mW	JmM	Omit	24mW	20mW	12mW	1mW	ОтМ	24mW	20mW	81mW	230mW	Mm!	ЭтМ	120mW	150mW	
REV.	RATED STRESS	35V	1000	1000	1000	1000	1000	1000	100mW	100mW	100mW	100mM	100mW	100mM	100mW	100mW	100mW	100mW	250mW	250mW	100mW	100mW	125mW	250kmW	
P/N D314311, R	FART NUMBER	M39003/03-0164	M39014/1C-1455	M39014/1C-1455	M39014/1C-1455	M39014/1C-1455	M39014/1C-1455	M39014/1C-1455	RNCSOHXXXXFM	RNCSOHXXXXFM	RNC50H49R9FM	RNC50H1002FM	RNC50H8201FM	RNCSOHXXXXFM	RNCSOHXXXXFM	RNC50H49R9FM	RNC50H1002FM	RNC50H8201FM	RCR07G102KM	RCR07G102KM	RNC50H2002FM	RNCSOHXXXXFM	RNC55H4990FM	RCR07G102KM	
(6 2°C)	PART DESCRIPTION	Capacitor, Solid Tantalum, 1.8µf	Capacitor, Ceramic, 0.01µf	Resistor, Fixed Film, Select	Resistor, Fixed Film, Select	Resistor, Fixed Film, 49.90	Resistor, Fixed Film, 10Kn	Resistor, Fixed Film, 8.2Kg	Resistor, Fixed Film, Select	Resistor, fixed film, Select	Resistor, Fixed Film, 49.92	Resistor, Fixed Film, 110KD	Resistor, Fixed Film, 8.2K2	Resistor, Fixed Composition, 1Ku	Resistor, Fixed Composition, 1Ka	Resistor, Fixed Film, 20Ku	Resistor, Fixed Film, Select	Resistor, Fixed Film, 4992	Resistor, Fixed Composition, 1Ka						
(AUF	RF F SYMBOL	(23	C24	C25	626	C23	C28	623	R2	R3	84	R7	R12	R14	R15	RI6	R19	R24	R30	R31	R32	R33	R34	R35	

TABLE 4-4A

PRODUCTION OF THE PRODUCT OF THE PRO

POWER SUPPLY RELIABILITY DATA

F.R. SOUPCE 2170 2170 2170 2170 2170 2170 2170 2170 2170 2170 7170 2170 2170 2170 2170 2170 FAILURE RATE 0.0134 0.0310 0.0134 0.0310 0.0133 0.0139 0.0133 0.0136 0.0213 0.0139 0.0151 0.0151 0.0134 0.0313 0.0133 0.0136 0.0174 0.0139 0.0725 STRESS RATIO 0.45 0.13 0.130.02 0.80 0.03 0.00 0.05 0.00 0.02 0.80 0.00 0.05 0.03 0.05 APPLIED STRESS 90m₩ BOmw W ₹ 5 SmW 15mW **M** 3mK 3ruh Suk BOMM BOMM SE SE 7 mW 27mW 3mW 3mM YER. 2mW 2mM 養 1 SE SE 31.1 RATED STRESS MmO0 Mun00 MW()() 100m 100mW 100m 100m Mm001 Mm001 100m 100m 100mH 100m 100mW 100m 250mW 300mW 11, REV PART NUMBER P/N D31 RNC90Y1K2000TM RNC50H2000FM RNC50H3011FM RNC50H2000FM RNC50H3011FM RNC50H1002FM RNC50H1002FM RNC50H2002FM RNC50H2002FM RNC50H2000FM RNC50H3011FM INCSOH6601FM RNC50H2002FM RNC50HXXXXFM RNC50H4991FM RNCSOHXXXXFM RNC50H4991FM RJR26HW502M 3.01Kg 4.66.4 4.99Kn 3.01Kn 3.01Kg Resistor, Fixed Film, Select Resistor, Potentiometer, 5Kg Select 6.65Kg Resistor, Fixed Film, 1.2Kg Resistor, Fixed Film, 2002 Resistor, Fixed Film, 10Ku Resistor, Fixed Film, 20K2 Resistor, Fixed Film, 2002 Resistor, Fixed Film, 20KB PART DESCRIPTION Resistor, Fixed Film, Kesistor, fixed film, Resistor, Fixed Film, Resistor Network P54, 10,410 R1, 60.4KL PS, 10Ku 2°C) REF SYMBOL R38 (39 R40 342 243 44 368 4.48 849 850 337 341 ₽.45 147 <u>.</u> 3 R36 852 PEOPY - 81678

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TABLE 4-4A POWER SUPPLY RELIABILITY DATA

	(AUF	(AUF @ 2°C)	P/N D314311, R	REV.			Sheet 6 of	f 6	
+60++ -	REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL JED Stress	STRESS RATIO	FAILURE RATE	F.R. Source	
):67 0	22	Resistor Network	038	125mW	28mW	0.22	0.0725	2170	
		R13, 60.4K3			3mK				
		R17, 10K3			3mk				
		R18, 1KD			20mM				
		R55, 60.4Kg			2mW				
	23	Resistor Network	000	125mW	27mW	0.22	9060.0	2170	
		R25, 1KA			OmM				
		R26, 1KA			Am _O				
В		R27, 750KG			Omlk				
- 33		R28, 10Kn			24mW				
	_	R29, 1KA			3mM				
	74	Resistor Network	300	125mW	1 1 mW	0.09	0.0659	2170	
		R8, 499Kn			ME				
		R9, 1Mn			OmW				
		R10, 499Kn			JmM				
		R11, 10Kn			Mm6				
	75	Resistor Network	000	125m₩	1 JmW	60.0	0.0659	2170	
		R20, 499Kn			Jak				
		R21, 1MΩ			Omi				
_		R22, 499Kn			JmM				
		R23, 10K!			Mini9				
	[]	Terminal (26 & 0.0247 ECH)	SCD 316774				0.6422	2170	
	PW81	Printed Wiring Bd. (2-sided)					0.4492	2170	
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TABLE 4-4B

POWER SUPPLY RELIABILITY DATA

TABLE 4-4B FOWER SUPPLY RELIABILITY DATA

of 6	F.R. SOURCE	2170		2170		2170		2170		2170			2170			2170			2170		2170		2170			
Sheet 2 c	FAILURE RATE	0.0013		0.0013		0.0013		0.0013		0.0009			0.0009			0.0007			0.0016		0.0016		0.0002			
	STRESS RATIO	0.00		0.00		0.00		0.00		90.0	0.30		0.15	.30		0.15	0.20		0.00		0.00		0.05	00.00		
	APPL 1ED STRESS	MO.	J-84	M	J.8₽	3	ე_8₺	3	ე_8₺	۸9	0.3A	ე"85	15V	0.3A	ງ 99	150	0.2A	24°€	₹	ე_8₺	M O	48°C	۱۸	OmA	48°C	
REV.	RATED STRESS	ME	175°C	₹ **	175°C	0.5W	ວູ002	WS.0	ວ₀002	1000	18	J_051	1000	14	150°C	1000	N I	150°C	₩5.0	J_051	MS.0	150°C	80v	200mA	175°C	
P/N D314311, R	PART NUMBER	MIL-S-19500/434	(JANTX1N5610)	MIL-S-19500/434	(JANTX1N5610)	1N5257/JANTX	_	1115257/JANTX		MIL-S-19500/477	(JANTX1N5804)		MIL-S-19500/477	(JANTX1N5804)		MIL-S-19500/477	(JANTX1N5804)		1N5231/JANTX		1N5231/JANTX		MIL-5-19500/231	(JANIX1N3600)		
30°C)	PART DESCRIPTION	Diode, SI, Zener		Diode, SI, Zener		Diode, SI, Zener		Diode, SI, Zener		Diode, SI, Rectifier			Diode, SI, Rectifier			Diode, SI, Rectifier			Diode, SI, Zener		Diode, SI, Zener		Diode, SI, GP			
(GF @ 30	REF SYMBOL	cR1		CR2		CR3		CR4		CR5			CR6			CR7			CR8		CR9		CR10			

TABLE 4-4B

POWER SUPPLY RELIABILITY DATA

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(GF @ 3	30°C)	P/N D314311, R	REV.			Sheet 3 o	of 6	
RŁF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPLIED STPESS	STRESS RATIO	FATEURE RATE	1 .R. Source	
5	Capacitor, Ceramic, 0.01pf	M39014/1C-1455	100v	150	0.15	0.0014	2170	
23	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1007	۸0	0.00	0.0012	2170	
3	Capacitor, Ceramic, 15sf	M39014/2f -1407	500	187	0.36	0.0055	2170	
64	Capacitor, Ceramic, 0.15f	M39014/1C-1473	507	287	95.0	0.0117	2170	
90	Capacitor, Ceramic, 0.01, f	M39014/1C-1455	1000	15V	0.15	0.0014	2170	
93	Capacitor, Ceramic, 0.01.1f	M39014/1C-1455	1000	۸0	0.00	0.0012	2170	
7.3	Capacitor, Ceramic, luf	M39014/2E-1407	200	18v	0.36	0.0055	2170	
83	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	\$0N	287	95.0	0.0117	2170	
60	Capacitor, Solid Tantalum, 6.8µf	M39003/03-0180	200	17.v	0.34	0.0213	2170	
C10	Capacitor, Solid Tantalum, 6.8µf	M39003/03-0116	100	2	01.0	0.0134	2170	
E	Capacitor, Ceramic, 33pf	M39014/1C-1210	2007	17.v	0.09	0.0007	2170	
(12	Capacitor, Ceramic, O 001µf	CCR05CG102. M	1000	۱۸	0.01	6000019	2170	
C13	Capacitor, Solid Tantalum, 82wf	M39003/03-0124	100	Λ9	09.0	0.0778	2170	
C14	Capacitor, Solid Tantalum, 47uf	M39003/03-0171	35V	16V	0.46	0.0419	2170	,
C15	Capacitor, Solid Tantalum, 47µf	M39003/03-0171	35V	167	0.46	0.0419	2170	
910	Capacitor, Ceramic, 0.001µf	M39014/1C-1237	200V	304	0.15	0.0011	2170	
C17	Capacitor, Solid Tantalum, 1.8uf	M39003/03-0164	357	15V	0.43	0.0252	2170	
C18	Capacitor, Ceramic, 0.001uf	M39014/1C-1237	200V	300	0.15	0.0011	2170	
613	Capacitor, Ceramic, 0.001µf	M39014/1C-1237	2000	3:10	0.15	0.0011	2170	
020	Capacitor, Ceramic, O.luf	M39014/1C-1473	50v	15V	0.30	0.0031	2170	
C21	Capacitor, Ceramic, 0.001µf	M39014/1C-1237	2000	200	0.10	0.0010	2170	
223	Capacitor, Solid Tantalum, 8.2uf	M39003/03-0118	100	ΛS	0.50	0.0398	2170	
				:				

TABLE 4-4B POWER SUPPLY RELIABILITY DATA

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SSSSSC STOREST STOREST NO. STO

9 4())	30 °C)	P/N D314311, R	REV.			Sheet 4 of	9
REF SYMBOL	PART DESCRIPTION	FART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RAT10	FAJLURE RATE	F.R. SOURCE
623	Capacitor, Solid Tantalum, 1.8µf	M39003/03-0164	357	15V	0.43	0.0252	2170
C24	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	150	0.15	0.0014	2170
523	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	15V	0.15	0.0014	2170
C26	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	15V	0.15	0.0014	2170
C27	Capacitor, Ceramic, 0.0luf	M39014/1C-1455	1000	15V	0.15	0.0014	2170
C28	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	15V	0.15	0.0018	2170
623	Capacitor, Ceramic, $0.01\mu f$	M39014/1C-1455	1000	15V	0.15	0.0018	2170
R2	Resistor, Fixed Film, Select	RNCSOHXXXXFM	100mW	12mW	0.12	0.0023	2170
R3	Resistor, fixed Film, Select	RNCSOHXXXXFM	100mW	M.E.	0.01	0.0020	2170
R4	Resistor, Fixed Film, 49.90	RNC50H49R9FM	100mW	Am O	00.00	0.0020	2170
R.7	Resistor, Fixed Film, 10Kg	RNC50H1002FM	100mW	2 4mW	0.24	0.0027	2170
R12	Resistor, Fixed Film, 8.2KQ	RNC50H8201FM	100mW	20mW	0.20	0.0026	2170
R14	Resistor, Fixed Film, Select	RNC50HXXXXFM	100mW	12mW	0.12	0.0023	2170
R15	Resistor, Fixed Film, Select	RNC50HXXXXFM	100mW	JmW	0.01	0.0020	2170
R16	Resistor, Fixed Film, 49.92	RNC50H49R9FM	100mW	Omik	00.0	0.0020	2170
R19	Resistor, Fixed Film, 110Kg	RNC50H1002FM	100mM	24mW	0.24	0.0027	2170
R24	Resistor, Fixed Film, 8.2Kg	RNC50H8201FM	100mW	20mW	0.20	0.0026	2170
R30	Resistor, Fixed Composition, 1Kg	RCR07G102KM	250mW	81mW	0.32	0.0018	2170
K31	Resistor, Fixed Composition, 1Kg	RCR07G102KM	250mW	230mW	0.92	0900.0	2170
R32	Resistor, Fixed Film, 20Kg	RNC50H2002FM	100mW	1mW	0.01	0.0020	2170
R33	Resistor, Fixed Film, Select	RNC50HXXXXFM	100mW	3mW	0.03	0.0021	2170
R34	Resistor, Fixed Film, 4992	RNC55H4990FM	125mW	120mW	96.0	0.0062	2170
R35	Resistor, Fixed Composition, 182	RCR07G102EM	250mW	150mW	09.0	0.0032	2170
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TABLE 4-4B

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SUPPLY RELIABILITY DATA POWER

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F.R. SOURCE 2170 2170 2170 2170 2170 2170 2170 2170 2170 2170 2170 217D 2170 2170 2170 2170 0.0020 0.0052 0.0266 0.0020 0.0024 0.0024 0.0404 FATI URI RATE 0.0052 0.0052 0.0021 0.0021 0.0034 0.0020 0.0071 0.9021 0.0021 0.0027 0.0021 0.0021 STRESS RATIO 0.80 0.03 0.00 0.45 0.00 0.13 0.13 0.80 0.00 0.02 0.80 0.02 0.05 0.02 0.05 0.03 0.05 0.26 0.22 APPLIED STRESS 45mW 3mW Jan. 2m¥ 80mW E E 2mW 30mW Smil ЗтМ J 3n⋅W 77mW 3mW SHE. E S 5mW P M M 7 mW 3 IL RATED STRESS MWO0 Mm00 MIMOO! Mw00: MILLOO 00mM Mulgo Mm001 00mM MmQ01 Mm001 100mW Mm001 MECOO. 100m Mm()() 250mW Mm001 P/N D314311, REV. NUMBER RNC90Y1K2000TM RNC50H200UFM RNC50H4991FM RMCSOH2002FM RNC50H2002FM RNC50H2000FM RNC50H3011FM RNC50H6601FM RNC50H2002FM RNC50H2000FM RNC50H3011FM RNC50H3011FM RNC50H1002FM RNC50H4991FM RNCSOHXXXXFM RNC50H1052FM RNCSOHXXXXFM RJR26HW502M PART 6.65Kg Select 3.01% 3.0.6 4.99Kn 4.99Kn Resistor, fixed film, Select Resistor, Potentiometer, 5Kg Pesistor, fixed film, 1.2Kg 20Kg 2002 Resistor, Fixed Film, 20K2 PART DUSCRIPTION Resistor, Fixed Film. Resistor, Fixed Film, Pesistor, Fixed Film, Resistor, fixed film. Resistor, Fixed Film, Projector, Fixed Film, Resistor, Fixed Film, Resistor, Fixed Film, Resistor, Fixed Film, Resistor, Fixed Film, Resistor Network 854, 60.4NU F1, 60.49: F5. 10EC 839 R49 543 845 P50 6410 R46 1447 848 R53 SYMBOL H37 R41 R42 414 RSI = .49)

SECTIONS SECTIONS DESCRIPTED EXCRESSION DESCRIPTED DISCLARED PERCESSES FACE

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TABLE 4-4B

POWER SUPPLY RELIABILITY DATA

Sheet 6 of 6	STRESS STRESS FAILURE F.R. SOURCE	125mW 28mW 0.22 0.0266 2170	Зти	Зты	20mW		125mW 27mW 0.22 0.0332 2170	Omit	Ohali	Omik	24mW	3mW	125mW 11mW 0.09 0.0254 2170	1mM	Оты	lmW.		125mW 11mW 0.09 0.0254 2170	Juh	Chill	1mW	Mu(6	0.1430 2170	
She	APPLIED STRESS STRESS RATIO	28mW 0.22	3mW	ЗшЖ	20mW		27mW 0.22	Omw	MuliO	Omw	24mW	MEE	11mW 0.09	1mW	Omw	MEI		11mW 0.09	MmI	OhnW	law	Maio	-	
P/N D314311, REV.	PART NUMBER	ODS					000						SCD					Sco					SCD 316774	
30°C)	PART DESCRIPTION	Resistor Network	R13, 60.4K2	R17, 10KG	R18, 1143	R55, 60.4Ki	Resistor Network	R25, 1K2	R26, 1161	R27, 750KG	R28, 10K2	R29, 1KO	Resistor Network	RB, 499KI	R9, 1MD	P10, 499K!	R11, 10Kg	Resistor Network	R20, 499KG	R21, 1M2	R22, 499Ka	R23, 10Kg	Terrinal (26 p. 6.6655 FCH)	
(Gi & 30	REF SYMBOL	22					73	 -	•				7.4					15					-	

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TOTAL

TABLE 4-40 POWER SUPPLY RELIABILITY DATA

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82 M801 01 1C, 02 1C, 03 1C, 04 1C, 05 1C,	PART DESCRIPTION IC, Linear, SW. Voltage Regulator IC, Linear, Dual Comparator India SK. Voltage Regulator India SK. Voltage Regulator	FAPT REIMBER	RAILE	APE, HP	22 1917	I A I I II K	3
	, Linear, SK. Veltage Regulator , Linear, Dual Comparator Linear SK Veltage Regulator		NIME CO	10 10 10 10 10 10 10 10 10 10 10 10 10 1		1194	Dallos
	, Timear, Boal Comparator Timear SK Voltace Mediator	47.				7.	2170
	My Argur	1 M1 43.05,85 33				<i>5</i>	0715
		UA785400M (8. 4. 4.					2170
	LIMMAR. SM. Wolf.	U4785430P (RE3H)	964			(4) (4) (4) (4) (4)	2175
	. Timear, Goal of Ar	P38510/110/59/H					2170
		(LM1244.1)					
2 	It, Linear, Voltage Pef JoV	also sparson and					2170
}	Transistor, Power off, 4	RFLANDSZUNDE	∑ 	Š	: :: :::	# C () 3	2170
•			15.30				
	Translittor, fower fr., h	RF 4M15 CANIX	- *	5	ю. Э	3	2170
				Š			
	The state of the s	12 Table 1 Table 1 Fig.	:	, <u>f</u>	17	-	2170
			1.5.1				
75	11.31531.11	(4) 영화 등 원화	40.	. <u>*</u>	(9)	1,300,0	2170
		(JANIX2429.15)	<u> </u>	H Out	(17		
),@12	- 1			
	Translit . (1, h.s.	1577 (5) 3713	.e. >=		0.00		2170
		COANTOUNCESSOR	Altra i n	. (1.) Hr s.	6.13		
	-			- 2			
	**		-	1	6.63	15 Table 1	2170
		(4.6.4.1.54.6)		7 - HUF.	6.12		
),,(1),				

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ABLE 4-40 FOWER TUPLY RELIABILITY DATA F R D314311, REV.

	- 1 0514511, KIV.	(I.V.			Sheet 2 of	f 6	
Section 1971 and the section of the	FART NUMBER	RATED STRESS	APPLIED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE	
	!	36	MO	0.00	0.0067	2170	
	(JANIXIN5610)	175°C	ე 85			_	
4	P.11-5 19500/434	36	ð	0.00	0.0067	2170	
	(JAN1X1N5610)	175°C	ე"85				
	185257/JANTX	WS.0	3	0.00	0.0067	2170	
		2002	ງ _° 85		-		
	INCCOLUMNIX	0.5W	30	0.00	0.0067	2170	
		200°C	ງ,,85				
•	M11-1-19500/477	1000	۸9	90.0	0.0047	2170	
	(JAN1x1N5804)	Y.	0.3A	0.30			
		150℃	J.89	,			
	MR 5-195002477	1001	154	0.15	0.0047	2170	
	(SANTE INSHINA)	18	0.3A	.30			
_		J ₀ 951	J, 99				
	# 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1004	154	0.15	0.0038	2170	
	THE WAY TO	4 -	0.2A	0.20			
		150.0	ن. نائی				
		. S.	3	0.00	2300.0	2170	
),,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,) 45				
	- - 4	3 5	3	00.00	0.0082	2170	
			٦í	20 0	0.0011	2170	
		4:	4	00.0			
		-	_	_		_	

_																							
	F.R. SOURCE	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2176	2176	2170	2170	2170	2170	2170	2170	2170	2170
	FAILURI PATE	9,6068	0.9061	6, 00, 75	28,0°0	39000	0.0261	6.0.75	0,0587	0.0783	0.0433	6.953	1.0046	6.839	0.1536	0.1536	0,0053	\$3500	£ (35) 3	(10.53	F. (15)	6,0049	6.1459
	11453 FA110	0.15	(,e) (D	0.34	98 0	4° 	χη. Ο	36.0	€, S	0.34	61.19	60.0	10 U	09.0	0.46	0.46	0.15	£ #3	(- 15	£ 1	o. 30	0.10	(.50
		· :.		•	.>				•		<i>:</i> .	•	.*	:	4	* **		**	<u>ب</u>		·:-	Air.	,
-			-		•		•		-			-		-	- · -	<u>.</u>	-		•	· ·	·*	•	<u></u>
					-	_	-						,								•		
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	-			,	2	,	•	,	,	,	,	1		,	,	,		,	3	-	,	,	,

TABLE 4- 40 COMER SUBERY RELIABILITY DATA

F / F [03]4311, REV.

	•					Sheet 4 of	f 6
		FAPT NUMBER	RATED STRESS	APPL LED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
	The state of the s	M390(3703-0164	35V	15V	0.43	0.0924	2170
	The second secon	M39014/10-1455	1000	15V	0.15	8900.0	2170
	The second of th	M39014/1C-1455	1000	15V	0.15	0.0068	2170
	The second secon	M39014/1C-1455	100v	15V	0.15	0.0068	2170
	LE TITE CETADOL CONT.	M39014/1C-1455	100v	150	0.15	0.0068	2170
,		H19014/1C-1455	100v	150	0.15	0.0088	2170
	The second of th	M39014/1C-1455	1000	150	0.15	0.0088	2170
		RNC. OHXXXXFM	100mW	12mW	0.12	0.0083	2170
	The State of the Select	RNCSOHXXXXFM	100mk	J. J.	0.01	0.0073	2170
.,	43 g. fined film, 43 g.	RNC50H49R9FM	100mW	AMO	0.00	0.0073	2170
	The state of the s	RNC50H1002FM	100ш	24mW	0.24	9600.0	2170
	The second of the second	RNC50H8201FM	100mW	20mW	0.20	0.0091	2170
	The Confirmation of the Conference	RNCSOHXXXXFM	100mW	12mW	0.12	0.0083	2170
	A Total Control of the Control of th	RNCSOHXXXXFM	100mW	J.	0.01	0.0073	2170
	1 1 1 1 1 1 1 1 1 1	RN. SOH49R9FM	100mW	OM M	0.00	0.0073	2170
		ENCSOH1002FM	100mW	24mW	0.24	9600.0	2170
	The second secon	RNUSOH8201FM	100mW	20mW	0.20	0.0091	2170
		P.R076102KM	250mW	81mW	0.32	9,000.0	2170
		RCP07G102KM	250mW	230mW	0.92	0.0256	2170
		RNC SUHOODSFM	100mW	JmK	0.01	0.0073	2170
	The second secon	HACETHAXXXEM	100mW	3mk	0.03	0.0074	2170
		M30608H55 - 47	125mW	120mW	96.0	0.0230	2170
		F F, 761028M	250mW	150mW	09.0	0.0134	2170

TABLE 4-4C POWER SUPPLY RELIABILITY DATA

of 6	F.R. SOURCE	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	21.10	-2170	2170	2170					
Sheet 5 c	FAILURE RATE	0.0073	0.0189	0.0073	0.0189	0.0074	0.0073	0.0073	0.0124	0.0073	0.0084	0.0084	0.0073	0.0189	0.0073	0.0076	0.0074	0.1612	0.0098	0.1232					
	STRLSS RATIO	0.02	08.0	0.02	08.0	0.03	0.00	0.05	0.45	00.0	0.13	0.13	0.05	08.0	00.00	0.05	0.03	0.05	92.0	0.22					
	APPLIED STRESS	2mW	80mW	2mW	80mW	ЗтЖ	OmM	5mW	45mW	Omit	13mW	13mW	2mM	80mM	OmM	SmW	3mW	13n·W	77mW	27mW	3miW	3mW	19mM	2mW	
REV.	RATED STRESS	100mW	100mW	100mW	100mW	100mW	100mW	100mW	100mW	100m	100mW	100mW	100m₩	100mW	100mW	100mW	100mW	250mW	300mW	125mW					
F/B D314311, REV.	LAFT NUMBER	PNCSOHPOODEM	RNC50H3011FM	PNC50H2000FM	RNC50H3G11FM	RNCSOHLOOPEM	RNC50H4991FM	RNCSOHXXXXFM	PNC5(H4991FM	PNC50H1002FM	RNCSUHZOOZEM	PMC50H2002FM	RECEDENT DOOR M	RNC50H3011FM	PNC50H6601FM	RNC50H2002FM	PhC50HXXXXFM	RJR26HW502M	PHC 90Y1K2000TM	dus					
		The state of the s		A Company of the State of the Company			The state of the s		The Park of the Control of the Contr					The state of the s	The state of the state of the state of		and the state of t	The state of the s		一 一 一 一 一 一 一 一 一 一 一 一 一 一 一 一 一 一 一	· · · · · · · · · · · · · · · · · · ·	-	•	.	

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TABLE 4-4C FOWER SUPPLY RELIABILITY DATA

Substituting Subs			-	WEBI 16 D	Clbfcc	ra i i ilor	1
125mM 28mM 0.22 0.1232 3mM 20mM 20mM 0.22 0.1540 125mM 27mM 0.22 0.1540 0mM 0mM 24mM 0.09 0.1198 175mM 11mM 0.09 0.1198 175mM 11mM 0.09 0.1198 1 mM 1 mM 0.09 0.1198 1 mM 1 mM 1 mM 0.09 0.1198 1 mM 1 mM 1 mM 0.09 0.1198 1 mM 1 mM 1 m	·	FAFT NUMBER	STRESS	APPLIED STRESS	STRESS RATIO	FAILURI RATE	F.R. SOURCE
3mW 20mW 2mW 20mW 2mW 0mW 0mW 175mW 11mW 0mW 0mW 11mW 0mW 0mW 11mW 0mW 0mW 11mW 0mW 0mW 0mW 11mW 0mW 0mW 0mW 0mW 0mW 0mW 0mW 0mW 0mW 0		<u>ت</u> ب	125mW	28mW	0.22	0.1232	2170
3mM 2mM 2mM 0.22 0.1540 (m) 0mM 0.22 0.1540 (m) 0mM 0mM 124mM 124mM 1mM 0.09 0.1198 1mM 0mM 1mm 1mm 0mM 0mM 0mM 0mM 0mM 0mM 0mM 0mM 0mM 0				3mM			
20mW				Mer.			
2mW 0.22 0.1540 0mW 0mW 0mW 0.009 0.1198 175mW 11mW 0.09 0.1198 1mW 0mW 1mW 0.09 0.1198 1mW 0.09 0.1198 1mW 0mW 0mW 1mW 0.09 0.1198 1mW 0mW 0mW 1mW 0.09 0.1198 1mW 0.09 0.119				20mW			
125mW 27mW 0.22 0.1540 0mW 0mW 3mW 0.09 0.1198 125mW 11mW 0.09 0.1198 1mW 0mW 1mW 0.09 0.1198 10mW 1mW 0.09 0.1198 1mW 0.09 0.1198				2mM			
Omb		313	125mW	27mW	0.22	0.1540	2170
Comb				M(m()			
24mW 3mW 1175mW 11mW 0.09 0.1198 1mW 0mW 1mW 0mW 1mW 0.09 0.1198 1mW 0mW 1mW 0.09 0.1198				Omik			
24mik 3mik 0.09 0.1198 1175mik 11mik 0.09 0.1198 0mik 0mik 0.09 0.1198 11mik 0mik 0.09 0.1198 11mik 0mik 0.09 0.1198				OmM			
3mW 0.09 0.1198 1mW 0mW 0mW 0mW 0mW 0mW 0mW 0mW 0mW 0mW 0				24mW			
125mW 11mW 0.09 0.1198 1mW 0mW 1mW 0.09 0.1198 125mW 11mW 0.09 0.1198 1mW 0mW 0.09 0.1198				3mlv			
175mk 11mk 0.09 0.1198 11mk 0.09 0.1198 1mk 0mk			Mm251	1 1 m/k	0.09	0.1198	2170
10 mm 10 m				Mel			
9miii 9miii 0.09 0.1198 1miii 0.09 0.1198 1miii 0.09 0.1198 9miii 9mii 9mii 0.1988				OmM			
9mii 11mii 0.09 0.1198 1mii 0mii 1mii 0mii 1mii 0mii 1mii 0mii 9mii 9mii 0.1988				19.5			
10.09 0.1198 10.04 (Anth 10.04) 90.04 (0.4940)				TK 125			
1mW 1mW 9mW 6.4840 0.1988			1.25mH	1 1 mM	60.0	0.1198	2170
1mM 9mM 6,4940		_	<u>.</u>	1 mil			
9mm (c. 434t) (c. 434t) (c. 434t)				(Ank)			
9mM				Nin!			
6,4940 0,698F		-		78 - 5			
		***				0,4940	0212
						.0.0387	2176

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TABLE 4-58 SBE MUTIFILER RELIABILITY DATA

		1 111		1		ייוניני די און	
1 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	DESCRIBITION	4 -	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAILURE	F.R. SOURCE
18	Linde, Stef Perovery	Aertech	3.	0.01W	0.01	0.1423	2170
			3,002	3°08			
	Lapacitor, Ceramic, 15pf	CDR126F150AJSM	50V	100	0.20	0.0008	2170
23	Capacitor, Ceramic, Spf	Epsilam	80s	100	0.20	0.0007	2170
(1)	Capacitor, Ceramic, Spf	Epsilam	200	100	0.20	0.0007	2170
[]	Inductor, (21, 828 Wire)		105°C	3°58		0.0168	2170
.:	into tur. TACL #de mire)		105℃	3°58		0.0168	2170

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TABLE 4 SC SEC MULLIFLIE PELIABILITY DATA

control controls by the control controls and controls and

				1		Sheet 1 of 1	1 1
į		<u> </u>	RATED STRESS	APPL 1FD STRFSS	STRESS RATIO	FATEURE RATE	F.R. SOURCE
a.	Augusta (au tain)	Aertech No. A4X707	M1 <	0.01W	0.01	0.6567	2170
			3.002	າ.08			
		CUR126P150AJSM	200	100	0.20	0.0041	2170
	Popular Cerest . Spi	[psilam	200	10v	0.20	0.0036	2170
	ingle of the certains a fig.	Epsilam	200	100	0.20	0.0036	2170
. •			ງ°201	3°58		0.0561	2170
;	•		ე°\$01	9°28		0.0561	2170
		:					

0.780

TOTAL

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TABLE 4-6A LAMP EXCITER PRINTED WIRING BOARD RELIABILITY DATA

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TOTAL 7.059

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LAMP EXCITER PRINTED WIRING BOARD RELIABILITY DATA TABLE 4-6B

F (5)	(C ₀ C)	P/N C316627, REV.	V . A		S	Sheet 1 of	1
94.8 8.448.01	FAPT DESCRIPTION	FART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAILURF RATE	r.R. SOURCE
10	Transistor, SI, RF Power	SCD 316782 (MSC82919)	45V 21.8W	15V 1.5W	0.33	1.3310	2170
CR.	Diode, SI, General Purpose	M1L-S-19500/231 (JANTX3600)	150°C 50V 200mA	127°C 1V 2mA	0.02	9.0000	2170
2 2	Capacitor, Ceramic Chip, 3.6pf Capacitor, Ceramic Chip, 150pf		09 2 6/1	14V 1V	0.28	0.0011	2170
C 2			50v 50v	15V 15V	0.30	0.0015	2170
CS .	Capacitor, Ceramic, 0.015µf Posistor, Fixed Film, 2E.u	RNC50H2001FM	50V 100mW	8V 18mW	0.16	0.0017	2170
2 2 2 2	Resistor, Fixed Film, 1000 Inductor, 0.744 Inductor, 2.244 Inductor, 2.244	RNC50H1000FM	100mW 150°C 150°C 150°C	OmW 116°C 116°C 116°C	0.00	0.0037 0.0254 0.0254 0.0254	2170 2170 2170 2170
7 M M M M M M M M M M M M M M M M M M M	Printed Wiring Bd. (2-sided)	B316627 PWB				0.0024	2170

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TOTAL

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TABLE 4- 6C

LAMP EXCITER PRINTED WIRING BOARD RELIABILITY DATA

. 96099 9:478

CM (B	40°C)	P/N C316627, REV	۷. ۶		S	Sheet 1 of	1
REF SYMROL	PART DESCRIPTION	PAPT NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FA11 URE RATE	F.R. SOURCE
10	Iransistor, SI, RF Power	SCD 316782	45V	15V	0.33	5.1920	2170
		(MSC82919)	21.8W	1.5W	0.07	-	
			ງ•051	127°€			
CR1	Diode, SI, General Purpose	M1L-S-19500/231	\$00	2.	0.05	0.0029	2170
·		(JANTX3600)	200mA	2mA	0.01		
			175°C	116°C			
5	Capacitor, Ceramic Chip, 3.6pf		200	140	0.28	0.0053	2170
23	Capacitor, Ceramic Chip, 150pf		200	1 V	0.05	0.0044	2170
3	Capacitor, Ceramic Chip, 27pF		200	150	0.30	0.0073	2170
54	Capacitor, Ceramic, 0.015µf		200	15V	0.30	0.0147	2170
C5	Capacitor, Ceramic, 0.015µf		200	8A	0.16	0.0084	2170
R1		RNC50H2001FM	100m₩	18mW	0.18	0.0153	2170
R2	Resistor, Fixed Film, 1000	RNC50H1000FM	100mW	Omk	0.00	0.0120	2170
1.1	Inductor, 0.7WH		150°C	3.911		0.0847	2170
1.2	Inductor, 2.244		150°C	3.911		0.0847	2170
1.3	Inductor, 2.2uH		150°C	3,911		0.0847	2170
PWB1	Printed Wiring Bd. (2-sided)	B316627 PWB				0.0079	2170
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		T	T			

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TABLE 4-7A RF PRINTED WIRING BOARD RELIABILITY DATA

960+V - 81678

(AUF A	2°C)	P/N C314303, RE	REV. B			Page 1 of	9
REF SYMBOL	PART DESCRIPTION	FART NUMBER	RATED STRESS	APPL 1ED STRI SS	STRESS RATIO	FAILURE RATE	f.R. SOURCE
n n	IC, tinear, Line Receiver	SNJ55140JG/8838	150°€	ე_05		0.1013	2170
n2	IC, Digital, Counter	JM38510/31504BFB	2,002	ວ ₈ 82		0.0634	2170
		(54(5161J)		-			-
n3	IC, Digital, NAND Gate	JM38510/300018CC	2002C	21℃		0.0470	2170
		(54LS00J)			•		
N4	IC, Digital, Counter	JM38510/315048EB	ວ.002	ე_82		0.0634	2170
		(54(S161J)					
nS	IC, Linear, Op Amp	SCD 31618D	ງ*0\$ເ	35°C		0.1745	2170
		(LM192H)					
90	IC, Digital, OR Gate	JM38510/053038CB	150°C	3,42		0.0475	2170
		(CD4030BF)					
1.5	Transistor, SI, NPN	SCD 316783	157	100	0.67	0.0314	2170
		(2N6304)	200mW	100mW	0.50		
			ງ.002	108℃			
02	Transistor, SI, NPN	SC0 316784	25V	200	08.0	0.0428	2170
		(MRF525)	2.5W	0.5₩	0.20		
			J.511	ე.,6₺			
60	Transistor, SI, NPN	M11-5-19500/343	15.4	30	0.20	0.0038	2170
		JANIY 282857)	M04002	¥m4	0.05		
),,:0,,	24°C			_
04	Transistor, SI, NFN	M11 - 5-195007.55	\$0¢	200	0.50	0.0186	2170
	-	(JANIY 24, 22, 27)	40.0km	100mW	0.25		
), 00,7) _U E 9			-
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TABLE 4-7A BETRIMEN WIETNO BEITABULITY BATA

-	(AUF #		И (колфія з м. з	н ∵ н	•	-	Page 2 of	ę
****	FFF SYMBOU	CART DESCRIPTION	or copy of the state of the sta	11110	APP II B		FA11 URE PATE	f.R. Smipci
14.78	90	ansistor, 51, NPP	99-199-1-1911	4::4	75.	0.38	0.0056	
			(# 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	d : Jenie	Ame	10.0		
				70KH2),1,			
	CRI	(node, Varactor	[H. +14]);	25: Jak	NE()	00.0	1.1400	2170
			1 Fig. 405.5. 546	1.521	0,0%			
	CR.?	Grade, 51, 66	A 24 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	465	۲,۷	60 v	0.0013	2170
			7, 4, 1, 12	£		79 3		
				5,00%	- -			
	CH3	[110de, 51, 6F	557) P	,	6 0 G	1000	2170
_				THE TANK]# EX	20 u		
				76,007	. 4 .			•
	CH4	(node, 51, 6f	¥.			#B 5	7	2170
			4 14 1.44	1	B	1 15		
	(H)		-	•	•		-	;-
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TACTICAL RUBIDIUM FREQUENCY STANDARD (TRFS) VOLUME 2 (U) EG AND G INC SALEM MA T J LYNCH ET AL. OCT 97 RADC-TR-87-166-VOL-2 F19628-83-C-8175 MO-M191 190 2/3 UNCLASSIFIED F/G 14/2 NL

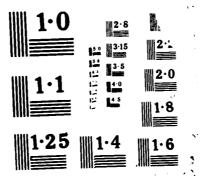


TABLE 4-7A

RF PRINTED WIRING BOARD RELIABILITY DATA

ı	(AUF @	2°C)	P/N C314303, REV	.V. B			Page 3 of	£ 6
76077-1	REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
	72	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	15V	0.15	0.0154	2170
	83	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	15V	0.15	0.0154	2170
	63	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	15V	0.15	0.0119	2170
	010	Capacitor, Ceramic, $0.01\mu f$	M39014/1C-1455	1000	15v	0.15	0.0119	2170
	CII	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	15V	0.15	0.0119	2170
	C12	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	٨	0.0	0.0107	2170
	C13	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	100	0.10	0.0142	2170
	C14	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	100	0.10	0.0110	2170
	C15	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	2.0	0.02	0.0137	2170
	913	Capacitor, Ceramic, 30pF	CCROSCGXXXJM	1000	100	0.10	0.00.0	2170
	C17	Capacitor, Ceramic, 6800pF	CCR05CG682JM	1000	80	0.08	0.0076	2170
	C18	Capacitor, Ceramic, 4700pF	CCR05CG472JM	100V	88	0.08	0.0072	2170
	613	Capacitor, Ceramic, Chip, 15pF	COR128P150AJSM	50V	100	0.20	0.0067	2170
	C20	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	2V	0.02	0.0137	2170
	C21	Capacitor, Ceramic, 0.001µf	CCR05CG102JM	100V	Λ0	00.0	0.0059	2170
	C22	Capacitor, Ceramic, $0.01\mu f$	M39014/1C-1455	100V	50	0.05	0.0107	2170
	C23	Capacitor, Tantalum, 6.8µf	M39003/01-2304	35V	15V	0.43	0.2996	2170
	C24	Capacitor, Ceramic, $0.01\mu f$	M39014/1C-1455	1000	100	0.10	0.0110	2170
	C25	Capacitor, Ceramic, $0.1\mu f$	M39014/1C-1473	1000	2Λ	0.05	0.0137	2170
	920	Capacitor, Ceramic, $0.1 \mu f$	M39014/1C-1473	1000	3V	0.03	0.0137	2170
	C27	Capacitor, Ceramic, 0.001µf	CCR05CG102JM	1000	00	0.00	0.0059	2170
	C28	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	20	0.05	0.0137	2170
ز			*					

TABLE 4-7A RF PRINTED WIRING BOARD RELIABILITY DATA

FART NUMBER STRESS STRESS RATIO RATE SOURCE	M39014/1C-1473 100V 5V 0.05 0.0137 2170	M39014/1C-1473 100V 5V 0.05 0.0137 217D	M39014/1C-1473 100V 5V 0.05 0.0137 2170	M39014/1C-1473 100V 15V 0.15 0.0154 2170	CCR05CG680JM 100V 0V 0.00 0.0042 217D	CCRO5CG331JM 100V 0V 0.00 0.00 0.0052 217D	M39003/01-2304 10V 5V 0.50 0.4769 217D	M39014/1C-1473 100V 15V 0.15 0.0154 217D	M39014/1C-1473 100V 8V 0.08 0.0139 217D	RNC50H1002FM 100mW 0mW 0.00 0.0133 2170	RNC50H51I1FM 100mW 5mW 0.05 0.0134 217D			RNC50H5461FM 100mW 10mW 0.10 0.0147 2170	RNC50H7501FM 100mW 5mW 0.05 0.0139 2170	RNC50H10R0FM 100mW 12mW 0.12 0.0150 217D	RNC50H2740FM 100mW 20mW 0.20 0.0163 217D	RNC50H1BR2FM 100mW 50mW 0.50 0.0225 217D	RNC50H2740FM 100mW 20mW 0.20 0.0163 217D	RNC50HXXXXXFM 100mW 5mW 0.05 0.0139 2170	RNC50H1002FM 100mW 0mw 0.00 0.0133 217D	RNC50H1501FM 100mW 34mW 0.34 0.0190 2170	-
		<u></u>	L C	15				15															
RATED STRESS	1000	100V	100V	1000	1000	100V	100	1000	1000	100m	100ms	100m	250ml	100m	100m	100mi	100ml	100m	100ml	100ml	100m	100™	100mW
FART NUMBER	M39014/1C-1473	M39014/1C-1473	M39014/1C-1473	M39014/1C-1473	CCR05CG680JM	CCR05CG331JM	M39003/01-2304	M39014/1C-1473	M39014/1C-1473	RNC50H1002FM	RNCSOHSIIIFM	RNC50H1002FM	RCR07G511KM	RNC50H5461FM	RNC50H7501FM	RNC50H10R0FM	RNC50H2740FM	RNC50H18R2FM	RNC50H2740FM	RNC50HXXXXFM	RNC50H1002FM	RNC50H1501FM	RNC50H1213FM
PART DESCRIPTION	Capacitor, Ceramic, 0.luf	Capacitor, Ceramic, $0.1\mu f$	Capacitor, Ceramic, $0.1\mu f$	Capacitor, Ceramic, $0.1 \mu f$	Capacitor, Ceramic, 60pf	Capacitor, Ceramic, 330pf	Capacitor, Tantalum, $33\mu f$	Capacitor, Ceramic, $0.1\mu f$	Capacitor, Ceramic, $0.1 \mu f$	Resistor, Fixed Film, 10Kn	Resistor, Fixed Film, 5.11KG	Resistor, Fixed Film, 10KQ	Resistor, Fixed Film, 5100	Resistor, Fixed Film, 5.46Kg	Resistor, Fixed Film, 7.5K Ω	Resistor, Fixed Film, 10%	Resistor, Fixed Film, 2749	Resistor, Fixed Film, 18.2Ω	Resistor, Fixed Film, 2742	Resistor, Fixed Film, 500	Resistor, Fixed Film, 10Kg	Resistor, Fixed Film, 1.5K%	Resistor, Fixed Film, 121K.

TESTER RESERVED TOTAL VERTICAL VERTICAL VALUE

TABLE 4-7A

RF PRINTED WIRING BOARD RELIABILITY DATA

P/N C314303, REV. B

-60+4 - 81678

(AUF @	2°C)	P/N C314303, REV	И. В			Page 5 of	9
REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RAT10	FAILURE RATE	F.R. SOURCE
R15	Resistor, Fixed Film, 3.01Ka	RNC50H3011FM	100mW	40mM	0.40	0.0202	2170
R16	Resistor, Fixed Film, 3.01Ka	RNC50H3011FM	100mW	40mM	0.40	0.0202	2170
R17	Resistor, Fixed Film, 100KG	RNC50H1003FM	100mW	OmiM	0.00	0.0133	2170
R18	Resistor, Fixed Film, 2KA	RNC50H2001FM	100mW	SmW	0.02	0.0134	2170
R19	Resistor, Fixed Film, 82.5Ω	RNC50H82R5FM	100m	4mM	0.04	0.0137	2170
R20	Resistor, Fixed Film, 7.5KD	RNC50H7501FM	100m	Jak	0.01	0.0133	2170
R21	Resistor, Fixed Film, 1000	RNC50H1000FM	100m	Зпъ	0.03	0.0136	2170
R22	Resistor, Fixed Film, 4.7KD	RNC50H4751FM	100mM	1mW	0.01	0.0133	2170
R23	Resistor, Fixed Film, 4.7KG	RNC50H4751FM	100mW	J. M.	0.01	0.0133	2170
R24	Resistor, fixed Film, 33.20	RNC50H33R2FM	100mW	20mW	0.20	0.0163	2170
R25	Resistor, Fixed Film, 6190	RNC55H6190FM	125mW	40mM	0.32	0.0185	2170
R26	Resistor, (Thermistor) 3.3Kg	RTH42ES332K	100mW	2mM	0.05	6.195	2170
R27	Resistor, Fixed Composition, 301Ω	RCR07G301KM	250mW	8mM	0.03	0.000.0	2170
R29	Resistor, Fixed Film, 10KA	RNC50H1002FM	100mW	MmO	0.00	0.0133	2170
R30	Resistor, Fixed Film, 5000	RNCSOHSOOOFM	100m	OmM	00.0	0.0133	2170
R31	Resistor, Fixed Film, 7.5KO	RNC50H7501FM	100mW	7mM	0.07	0.0142	2170
R32	Resistor, Fixed Film, 4750	RNC50H4750FM	100™]mM	0.01	0.0133	2170
R33	Resistor, Fixed Film, 27Ω	RNC50H27R0FM	100mW	2mW	0.05	0.0134	2170
۲.	Crystal, 90MHz	A316630				0.2000	2170
I	Transformer, 90MHz (OUT)	8316778	105°C	21°C		0.2341	2170
12	Transformer, RF	SCD 316787	ງ∿201	21°C		0.2341	2170
				-			
13	Transformer, SMHz (OUI)	8316770	105°C	21°C		0.2341	2170

TABLE 4-7A RF PRINTED WIRING BOARD RELIABILITY DATA

P/N C314303, REV. B

CONTRACTOR DESCRIPTION OF THE PROPERTY.

(AUF	a	2°C)					Page 6 of	9
REF SYMBOL	Rot	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPLIED STRESS	STRESS RAT10	FAILURE RATE	F.R. SOURCE
=		Inductor, Tuning	B316779	105°C	21°C		0.0164	2170
17		Inductor, 0.22µH	M39003/3	105°C	21°€		0.0164	2170
	-		-AR22KM					
13		Inductor, 4.7µH	M39010/1	105°C	21°C		0.0164	2170
			-A4R7KM	_				
1.4		Inductor, 15mH	M39010/3	າ05°C	21°C		0.0164	2170
			-A153KM					
15		Inductor, 2.2mH	M39010/3	105°C	21°€		0.0164	2170
			-А222КМ					
97		Inductor, 470µH	M39010/3	J.50t	21℃		0.0164	2170
			-A471KM					
77	-	Inductor, 220µH	M39010/3	105℃	21°C		0.0164	2170
			-A221KM					
18		Inductor, 220µH	M39010/3	105℃	21°C		0.0164	2170
			-A221KM					
5		Connector	SCD 316777				0.0732	2170
						-	0 0000	0716
Ξ	. — —	lerminal (Qty. 9)	SCD 316774				0.6663	0/17
PW81		Printed Wiring Bd (2-sided)				-	0.4104	2170
						-		
								
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TABLE 4-7B

DATA
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	(GF @ 3	(D ₀ 0s	P/N C314303, REV. B	EV. B			Page 1 of	9
	REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL 1FD STRFSS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
	L)	IC, Linear, Line Receiver	SNJ55140JG/883B	150°C	78°C	-	0.1200	2170
	N2	1C, Digital, Counter	JM38510/31504BEB	ე_002	ງ .9 5		0.0240	2170
			(54LS161J)					
	U3	IC, Digital, NAND Gate	JM38510/30001BCC	ე。002	46℃		0.0138	2170
			(54LS00J)					
	U4	IC, Digital, Counter	JM38510/31504BEB	200°C	ე"95		0.0240	2170
			(54LS161J)					
	US	IC, Linear, Op Amp	SCD 316TBD	ງ ₋ 051	93°C		0.1336	2170
			(LM192H)					
	90	1C, Digital, OR Gate	JM38510/053038CB	150°C	ე"55		0.0167	2170
			(CD4030BF)					
	016	Transistor, SI, NPN	SCD 316783	15V	10v	0.67	0.0040	2170
			(2N6304)	200mW	100mW	0.50		
				ე_002	136°C			
_	05	Transistor, SI, NPN	SCD 316784	25V	200	0.80	0.0052	2170
			(MRF525)	2.5W	MS.0	0.20		
				175°C	J°77			
	03	Transistor, SI, NPN	MIL-S-19500/343	15V	38	0.20	0.0005	2170
			JANTX2N2857)	200mW	Amy	0.05		
				3.00Z	25°C			
	04	Iransistor, SI, NPN	M1L-S-19500/255	400	200	0.50	0.0024	2170
			(JANTX2N2222A)	400mW	100mW	0.25		
				ວູ002	ე°16			
1								

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TABLE 4-7B

RF PRINTED WIRING BOARD RELIABILITY DATA

	(GF 19 3	30°C)	P/N C314303, RE	REV. B		14	Page 2 of	9
94097 · (RE F SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL JED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
1470	95	Transistor, SI, NPN	MIL-S-19500/255	40V	15V	0.38	0.0007	2170
			(JANTX2N2222A)	400mM	Эты	0.01		
				ე₀00₹	ე°6 ≯			
	CR ₂	Diode, Varactor	SCD 316781	250mW	Omin	0.00	0.0862	2170
			(DKV6534C)	125°C	ე ₈ 8			
	CR2	Diode, SI, GP	MIL-S-19500/444	75V	28	0.09	0.0002	2170
			(JANTXIN5711)	250mW	SmW	0.02		
				200°C	25°C			
	CR3	Diode, SI, GP	MIL-S-19500/444	85V	20	0.09	0.0005	2170
			(JANTX1N5711)	250mM	Smil	0.02		
				ე。002	25°C			
	CR4	Diode, SI, GP	M1L-S-19500/116	1000	36	0.03	0.0002	2170
			(JANTXIN4148-1	200mW	Mm9	0.03		
				175°C	25°C			
	CRS	Diode, SI, GP	M1L-S-19500/116	1000	۱۸	0.01	0.0002	2170
			(JANTX1N4148-1)	200mW	Omik	0.00		
				175°C	J°8₽			
	5	Capacitor, Ceramic, 22pf	CCR05CG220JM	1000	15v	0.15	9000.0	2170
	C2	Capacitor, Ceramic, 82pF	CCR05CG820JM	1000	100	0.10	0.0007	2170
	3	Capacitor, Ceramíc, O.luf	M39014/1C-1473	1001	7.4	0.02	0.0015	2170
	C4	Capacitor, Ceramic, 0.01mf	M39014/1C-1455	1000	۸6	0.09	0.0012	2170
-	3	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	100V	1 1	0.01	0.0012	2170
	9)	Capacitor, Ceramic, O.luf	M39014/1C-1473	1001	150	0.15	0.0018	2170
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TABLE 4-7B

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RF PRINTED WIRING BOARD RELIABILITY DATA

(GF &	30.0)	P/N C314303, RE	REV. B			Page 3 of	Ę 6
REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL IED STRESS	STRESS RATIO	FAILURE RATE	F.R. Source
73	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	100v	15V	0.15	0.0018	2170
83	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	15V	0.15	0.0018	2170
<u></u>	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	15V	0.15	0.0014	2170
C10	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	15V	0.15	0.0014	2170
[]	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	15V	0.15	0.0014	2170
C12	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	۸۸	0.07	0.0012	2170
C13	Capacitor, Ceramic, 0.01 _µ f	M39014/1C-1455	1000	100	0.10	0.0016	2170
C14	Capacitor, Ceramic, $0.01_{ m pf}$	M39014/1C-1455	1000	100	0.10	0.0013	217D
C15	Capacitor, Ceramic, $0.1\mu f$	M39014/1C-1473	1000	2.0	0.02	0.0016	2170
910	Capacitor, Ceramic, 30pf	CCROSCGXXXJM	1000	10v	0.10	0.0059	217D
C17	Capacitor, Ceramic, 6800pf	CCR05CG682JM	1000	88	0.08	0.0011	2170
C18	Capacitor, Ceramic, 4700pf	CCR05CG472JM	1000	84	0.08	0.0011	2170
613	Capacitor, Ceramic, Chip, 15pf	COR128P150AJSM	200	107	0.20	0.0008	2170
070	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	28	0.05	0.0016	2170
C21	Capacitor, Ceramic, 0.001µf	CCR05CG102JM	1000	Λ0	00.00	0.0009	2170
C22	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	28	0.05	0.0012	2170
(23	Capacitor, Tantalum, 6.8µf	M39003/01-2304	35V	15V	0.43	9620.0	2170
C24	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	100	01.10	0.0013	2170
523	Capacitor, Ceramic, 0.1uf	M39014/1C-1473	1000	24	0.05	0.0016	2170
9?)	Capacitor, Ceramic, 0.1pf	M39014/1C-1473	1000	3V	0.03	0.0016	2170
(2)	Capacitor, Ceramic, 0.001pf	CCRUSCG102JM	1000	۸0	00.0	0.0000	2170
678	Capacitor, Ceramic, 0.1uf	M39014/1C-1473	1000	5.0	0.05	0.0016	2170
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RECECCE ASSESSED ASSESSED PRODUCT VERSONS NOOSESSED

TABLE 4-7B RF PRINTED WIRING BOARD RELIABILITY DATA

(CF @ 3	30°C)	P/N C314303, REV. B	:V. B		Đ.	Page 4 of	9
REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL IED STRESS	STRESS RATIO	FAILURE RATE	r . R. Source
623	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	100V	5V	0.05	0.0016	2170
083	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	20	0.05	0.0016	2170
(3)	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	20	0.05	0.0016	2170
C33	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	15V	0.15	0.0018	2170
C34	Capacitor, Ceramic, 60pf	CCR05CG680JM	1000	۸٥	0.00	9000.0	2170
(35	Capacitor, Ceramic, 330pF	CCR05CG331JM	1000	٥	0.00	0.0008	2170
9£3	Capacitor, Tantalum, 33µf	M39003/01-2304	100	28	0.50	0.0471	2170
C37	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	15V	0.15	0.0018	2170
638	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	84	0.08	0.0016	2170
R.1	Resistor, Fixed Film, 10KG	RNC50H1002FM	100mW	Omik	0.00	0.0010	2170
R2	Resistor, Fixed Film, 5.11KD	RNC50H5111FM	100mW	SmW	0.05	0.0021	2170
R3	Resistor, Fixed Film, 10KΩ	RNC50H1002FM	100mW	VIII/	0.07	0.0022	2170
R4	Resistor, Fixed Film, 5100	RCR07G511KM	250mW	100mW	0.40	0.0022	2170
R5	Resistor, Fixed Film, 5.46KO	RNC50H5461FM	100mW	10mW	0.10	0.0023	2170
R6	Resistor, Fixed Film, 7.5KQ	RNC50H7501FM	100mW	5mW	0.05	0.0021	2170
R7	Resistor, Fixed Film, 10%	RNC50H10R0FM	100m₩	12mW	0.12	0.0023	2170
88	Resistor, Fixed Film, 2742	RNC50H2740FM	100mW	20mW	0.20	0.0026	2170
R9	Resistor, Fixed Film, 18.20	RNC50H18R2FM	100mW	50mW	0.50	0.0036	2170
R10	Resistor, Fixed Film, 2742	RNC50H2740FM	100mW	20mW	0.20	0.0026	2170
RII	Resistor, Fixed Film, 50%	RNCSOHXXXXFM	100mW	SmW	0.05	0.0021	2170
R12	Resistor, Fixed Film, 10K2	RNC50H1002FM	100nt	MITHO MITHO	0.00	0.0020	2170
813	Resistor, Fixed Film, 1.5Kz	RNC50H1501FM	Mm00!	34mW	0.34	0.0030	2170
R14	Resistor, Fixed Film, 121Ku	RNC50H1213FM	100mW	Jmk	0.01	0.0022	2170
	T	T					

ESECULIO DE LOS DESERVOS DE LOS DE LA COMPARA DE LA COMPAR

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TABLE 4-7 BR RELIABILITY DATA

96094 - 81678

	F.R. SOURCE	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	0715	2170	2170	2170	2170	2170	2170
Page 5 of 6	ľ	0.0032	0.0032 3			0.0021	0.0020	0.0021 2	0.0020	0.0020	0.0026	0.0029			0.0020			0.0020 2	0.0021	0.2000	0.1641 2	0.1641 2	0.1641 2
Pa	STRESS F RATIO	0.40	0.40	0.00	0.02	0.04	0.01	0.03	0.01	0.01	0.20	0.32	0.02	0.03	0.00	0.00	0.07	0.01	0.02			-, , -	
	APPLIED STRESS	40mW	40mM	MmO	2mW	4mW	JE!	3mw	1mk	1mk	20mW	40mM	2mM	8mM	Omk	Omiv	7mW	Je I	2mW		2°€	49°C	49°C
/. B	RATED STRESS	100mW	100mW	100mW	100mW	100miw	100mW	100mW	100mW	100mW	100mW	125mW	100mW	250mW	100mW	100mW	100mW	100mW	100mW		105°C	105°C	105°C
P/N C314303, REV.	PART NUMBER	RNC50H3011FM	RNC50H3011FM	RNC50H1003FM	RNC50H2001FM	RNC50H82R5FM	RNC50H7501FM	RNC50H1000FM	RNC50H4751FM	RNC50H4751FM	RNC50H33R2FM	RNC55H6190FM	RTH42ES332K	RCR07G301KM	RNC50H1002FM	RNC50H5000FM	RNC50H7501FM	RNC50H4750FM	RNC50H27R0FM	A316630	8316778	SCD 316787	8316770
30°C)	PART DESCRIPTION	Resistor, Fixed Film, 3.01KD	Resistor, Fixed Film, 3.01Ka	Resistor, Fixed Film, 100Kg	Resistor, Fixed Film, 2Ks	Resistor, Fixed Film, 82.50	Resistor, Fixed Film, 7.5KΩ	Resistor, Fixed Film, 1000		Resistor, Fixed Film, 4.7KΩ	Resistor, Fixed Film, 33.20	Resistor, Fixed Film, 6190	Resistor, (Thermistor) 3.3KB	Resistor, Fixed Composition, 301 Ω	Resistor, Fixed Film, 10Kn	Resistor, Fixed Film, 5000	Resistor, Fixed Film, 7.5KΩ	Resistor, Fixed Film, 475Ω	Resistor, Fixed Film, 27 Ω	(rystal, 90MHz	Transformer, 90MHz (OUI)	Transformer, Rf	Transformer, 5MHz (OUT)
е 30	RE F SYMBOL	R15	R16	R17	R18	R19	R20	R21	R22	R23	R24	R25	R26	R27	R29	R30	R31	R32	R33				

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TABLE 4-7B RF PRINTED WIRING BOARD RELIABILITY DATA

TOTAL RECEIPED CONTROL OF CONTROL

_ ლ [_	30°C)	P/N C314303, RE	REV. B			Page 6 of	9
	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPLIED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
Induc	Inductor, Tuning	8316779	3°201	49°C		0.0073	2170
Induc	Inductor, 0.22µH	M39003/3	105℃	J.64		0.0073	2170
		-AR22KM					
Induc	Inductor, 4.7µH	M39010/1	105°C	ე.67		0.0073	2170
		-A4R7KM					
Induc	Inductor, 15mH	M39010/3	105°C	ე∘6₱		0.0073	2170
		-A153KM					
Induc	Inductor, 2.2mH	M39010/3	105°C	ე.6₺		0.0073	2170
		A222KM					
Induc	Inductor, 470µH	M39010/3	J°201	3.6₺		0.0073	2170
		-A471KM				_	
Induc	Inductor, 220µH	M39010/3	105°C	ე₀6⊅		0.0073	2170
		-A221KM					
Induc	Inductor, 220µH	M39010/3	105°C	ქ ე。6₺		0.0073	2170
		-A221KM					
Connector	ctor	SC0 316777				0.0102	2170
	10	,				3040	
E e	lerminai (4ty. 9)	Scu 316/74				0.040.0	0/17
Print	Printed Wiring 8d (2-sided)					0.0270	2170
	•						
1							

B-63

TOTAL

SONOSON SUCCESSION PROPERT NORMAN PROPERTY FRANCES

1.967

TABLE 4-7C RF PRINTED WIRING BOARD RELIABILITY DATA

	f.R. Source	21.70	2170		2170	-	2170		2170		2170		2170			2170			2170			2170			
Page 1 of 6	FAILURE RATE	Ú.2142 3	0.0404 2		0.0232 2		0.0404 2		0.2448 2		0.0297 2		0.0143 2			0.0179 2			0.0016 2			u. 0085 2	_		
ď	STRESS RATTO						<u> </u>				-	,	19.0	0.50		08.0	0.20		0.20	0.02		0.50	0.25		
	APPL LED STRESS	3°88	ر 1 ₀ 99		ე。69		ე"99		73°C		ე"59		100	100mW	146°C	200	0.5W	81°C	30	4m¥	J.29	200	100mW] 0, [ot	
REV. B	RATED STRESS	150°C	ე。002		ე_002		ე₀002		150°C		ງ _° 051		15V	200mW	200 <i>2</i>	25V	2.5W	175°C	15V	200mW	ງ ₂ 002	404	400mW	3,00Z	
P/N C314303, R	PART NUMBER	SNJ35140JG/8838	JM38510/31504BEB	(54LS161J)	JM38510/30001BCC	(54LS00J)	JM38510/31504BEB	(54LS161J)	SCD 316TBD	(LM192H)	JM38510/053038CB	(CD40308F)	SCD 316783	(2N6304)		SCD 316784	(MRF 525)		MIL-S-19500/343	JANTX2N2857)		MIL-S-19500/255	(JANTX?N2222A)		
(٥,٠)	PART DESCRIPTION	IC, Linear, Line Receiver	IC, Digital, Counter		IC, Digital, NAND Gate		IC, Digital, Counter		IC, Linear, Op Amp		IC, Digital, OR Gate		Transistor, SI, NPN			Transistor, SI, NPN			Transistor, SI, NPN			Transistor, SI, NPN			
(GM @ 40°C)	REF SYMBOL	17 10	N2		n3		U4		0.5		9n 8-6		6			20			43			04			

TABLE 4-7C
RF PRINTED WIRING BOARD RELIABILITY DATA

Q5 Transistor, S1, NPM PARI DMUMBER SIRISS STRISS FALLURY F.R. Q5 Transistor, S1, NPM HIL-S-19500/255 40V 15V 0.38 0.0024 217D CR1 Diode, Varactor (JANIXZN2222A) 200°C 59°C 0.009 0.001 217D CR2 Diode, S1, GP HIL-S-19500/244 55V 5V 0.09 0.0011 217D CR2 Diode, S1, GP HIL-S-19500/444 55V 5V 0.09 0.0011 217D CR3 Diode, S1, GP HIL-S-19500/444 55V 5V 0.09 0.0011 217D CR3 Diode, S1, GP HIL-S-19500/444 55V 5V 0.09 0.0011 217D CR3 Diode, S1, GP HIL-S-19500/116 100V 3V 0.03 0.0011 217D CR4 Diode, S1, GP HIL-S-19500/116 100V 3V 0.03 0.0011 217D CR5 Diode, S1, GP HIL-S-19500/116 100V <t< th=""><th> 6 MS)</th><th>40°C)</th><th>P/N C314303, RE</th><th>REV. B</th><th></th><th></th><th>Page 2 of</th><th>9</th></t<>	 6 MS)	40°C)	P/N C314303, RE	REV. B			Page 2 of	9
Transistor, SI, NPN HIL-S-19500/255 400 15V 0.38 0.0024	RE I SYMBOL	PART DESCRIPTION	FART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAILURE RATE	f.R. SOURCE
Diode, Varactor CONTINUED CONTINUED S9°C S9°C S9°C CONTINUED C	95	Transistor, SI, NPN	M1L-S-19500/255	400	15V	0.38	0.0024	2170
Diode, Varactor SCD 316781 250m4 Omb 0.000 0.4465			(JANTX2N2222A)	400mW	3mk	0.01		
Diode, Varactor SCD 316781 250mW OmW O.00 0.4465				2000°C	ວ 65			
2 Diode, SI, GP HIL-S-19500/444 550 560 0.0011 3 Diode, SI, GP HIL-S-19500/444 550 550mW 5mW 0.02 3 Diode, SI, GP HIL-S-19500/444 550 500 0.0011 4 Diode, SI, GP HIL-S-19500/116 100V 3V 0.03 5 Diode, SI, GP HIL-S-19500/116 100V 3V 0.03 6 Diode, SI, GP HIL-S-19500/116 100V 3V 0.03 7 Capacitor, Ceramic, Capacitor, Ceramic, Collyf H39014/IC-1473 100V 1V 0.01 0.0035 7 Capacitor, Ceramic, 0.01yf H39014/IC-1455 100V 1V 0.01 0.0035 7 Capacitor, Ceramic, 0.01yf H39014/IC-1455 100V 1V 0.01 0.0035 7 Capacitor, Ceramic, 0.01yf H39014/IC-1455 100V 1V 0.01 0.0062 8 Capacitor, Ceramic, 0.01yf H39014/IC-1455 100V 1V 0.01 0.0062 8 Capacitor, Ceramic, 0.01yf H39014/IC-1473 100V 1V 0.01 0.0062 8 Capacitor, Ceramic, 0.01yf H39014/IC-1473 100V 1V 0.01 0.0062 8 Capacitor, Ceramic, 0.01yf H39014/IC-1473 100V 1V 0.015 0.0062	CR1	Diode, Varactor	SC0 316781	250mW	OmM	0.00	0.4465	2170
2 Diode, S1, GP (JANTXINS711) 250mk 5mk 0.09 200°C 62°C 62°C 62°C 4 Diode, S1, GP (HIL-S-19500/444 55W 50M 5mk 0.00 200°C 62°C 62°C 62°C 62°C 62°C 62°C 62°C 62			(DKV6534C)	125°C	ე。85			
Diode, SI, GP MIL-S-19500/444 55V 50W 0.09 0.0011	CR2	Diode, SI, GP	M1L-S-19500/444	557	20	0.09	0.0011	2170
Diode, SI, GP MIL-S-19500/444 55V 55V 0.09 0.0011			(JANTX1N5711)	250mW	5mW	0.05		
3 Diode, SI, GP MIL-S-19500/444 55V 5V 0.09 0.0011 4 Diode, SI, GP MIL-S-19500/116 100V 3V 0.03 0.0011 5 Diode, SI, GP MIL-S-19500/116 100V 3V 0.03 0.0011 5 Diode, SI, GP MIL-S-19500/116 100V 1V 0.03 0.0011 5 Diode, SI, GP MIL-S-19500/116 100V 1V 0.03 0.0011 6 Diode, SI, GP MIL-S-19500/116 100V 1V 0.03 0.0011 7 Capacitor, Ceramic, SI, GP MIL-S-19500/116 100V 1V 0.01 0.003 8 Capacitor, Ceramic, SI, GP MIL-S-19500/116 100V 1V 0.10 0.003 9 Capacitor, Ceramic, Olluf M39014/IC-1473 100V 7V 0.00 0.006 1 Capacitor, Ceramic, Olluf M39014/IC-1455 100V 1V 0.01 0.009 0.0062 1 Capacitor, Ceramic, Olluf				ე _° 002	2°59			
Diode, SI, GP	CR3	Diode, S1, GP	MIL-S-19500/444	55٧	20	0.09	0.0011	2170
4 Diode, SI, GP MIL-S-19500/116 100V 3V 0.03 0.0011 5 Diode, SI, GP MIL-S-19500/116 100V 3V 0.03 0.0011 5 Diode, SI, GP MIL-S-19500/116 100V 1V 0.01 0.0011 5 Diode, SI, GP MIL-S-19500/116 100V 1V 0.01 0.0011 6 Capacitor, Ceramic, 22pf CCR05CG220JM 100V 15V 0.15 0.0032 Capacitor, Ceramic, B2pf CCR05CG220JM 100V 15V 0.15 0.0036 Capacitor, Ceramic, O.lyf M39014/1C-1473 100V 7V 0.07 0.0080 Capacitor, Ceramic, O.llyf M39014/1C-1455 100V 1V 0.01 0.0062 Capacitor, Ceramic, O.llyf M39014/1C-1455 100V 1V 0.01 0.009 Capacitor, Ceramic, O.lbyf M39014/1C-1455 100V 1V 0.01 0.01 Capacitor, Ceramic, O.lbyf M39014/1C-1453 100V 1V 0.01 0.01 <			(JANTX1N5711)	250mW	Smik	0.02		
6 Diode, SI, GP MIL-S-19500/116 100V 3V 0.03 0.0011 5 Diode, SI, GP MIL-S-19500/116 100V 1V 0.03 0.0011 5 Diode, SI, GP MIL-S-19500/116 100V 1V 0.01 0.0011 Capacitor, Ceramic, 22pf CCR05GG220JM 100V 15V 0.15 0.0032 Capacitor, Ceramic, 82pf CCR05GG20JM 100V 15V 0.15 0.0032 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 7V 0.07 0.0080 Capacitor, Ceramic, 0.01µf M39014/1C-1455 100V 9V 0.09 0.0062 Capacitor, Ceramic, 0.01µf M39014/1C-1455 100V 9V 0.09 0.0062 Capacitor, Ceramic, 0.01µf M39014/1C-1455 100V 9V 0.09 0.0062 Capacitor, Ceramic, 0.01µf M39014/1C-1455 100V 1V 0.15 0.008				200c	0°59			
Some Community Community	CR4	Diode, SI, GP	MIL-S-19500/116	1000	30	0.03	0.0011	2170
175°C 62°C			(JANTX1N4148-1	200mW	Pm9	0.03		
Diode, SI, GP				175°C	0°29			
Capacitor, Ceramic, 22pf CCR05CG220JM 100v 15°C 58°C Capacitor, Ceramic, 82pf CCR05CG820JM 100v 15v 0.15 0.0032 Capacitor, Ceramic, 0.1pf M39014/1C-1473 100v 7v 0.07 0.0080 Capacitor, Ceramic, 0.01pf M39014/1C-1455 100v 9v 0.09 0.062 Capacitor, Ceramic, 0.01pf M39014/1C-1455 100v 1v 0.01 0.062 Capacitor, Ceramic, 0.1pf M39014/1C-1455 100v 1v 0.01 0.01	CR5	Diode, SI, GP	MIL-S-19500/116	1000	10	0.01	0.0011	2170
Capacitor, Ceramic, 22pf CCR05CG220JM 100V 15°C 0.0032 Capacitor, Ceramic, 82pf CCR05CG820JM 100V 10V 0.10 0.0035 Capacitor, Ceramic, 0.1lpf M39014/1C-1455 100V 7V 0.07 0.0080 Capacitor, Ceramic, 0.0lpf M39014/1C-1455 100V 9V 0.09 0.0062 Capacitor, Ceramic, 0.0lpf M39014/1C-1455 100V 1V 0.01 0.0062 Capacitor, Ceramic, 0.1lpf M39014/1C-1455 100V 1V 0.01 0.009			(JANTX1N4148-1)	200mW	OmW	00.00		
Capacitor, Ceramic, 22pf CCR05CG220JM 100V 15V 0.15 0.0032 Capacitor, Ceramic, 0.1pf CCR05CG820JM 100V 10V 0.10 0.0035 Capacitor, Ceramic, 0.01pf M39014/1C-1455 100V 9V 0.09 0.0062 Capacitor, Ceramic, 0.01pf M39014/1C-1455 100V 1V 0.09 0.0062 Capacitor, Ceramic, 0.01pf M39014/1C-1455 100V 1V 0.01 0.0662				175°C	ე _ა 85			
Capacitor, Ceramic, 82pf CCR05CG820JM 100V 10V 0.10 0.0035 Capacitor, Ceramic, 0.01pf M39014/1C-1455 100V 7V 0.07 0.0080 Capacitor, Ceramic, 0.01pf M39014/1C-1455 100V 9V 0.09 0.062 Capacitor, Ceramic, 0.01pf M39014/1C-1455 100V 1V 0.01 0.0661 Capacitor, Ceramic, 0.1pf M39014/1C-1473 100V 15V 0.15 6.0088		Capacitor, Ceramic, 22pf	CCR05CG220JM	1000	150	0.15	0.0032	2170
Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 7V 0.07 0.0080 Capacitor, Ceramic, 0.01µf M39014/1C-1455 100V 9V 0.09 0.062 Capacitor, Ceramic, 0.01µf M39014/1C-1455 100V 1V 0.01 0.0661 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.15 0.0088	(2	Capacitor, Ceramic, 82pf	CCR05CG820JM	1004	100	0.10	0.0035	2170
Capacitor, Ceramic, 0.01µf M39014/1C-1455 100V 9V 0.09 0.062 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 1V 0.01 0.068 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.15 0.08B	S	Capacitor, Ceramic, 0.15f	M39014/1C-1473	1000	٧٢	0.07	0.000.0	2170
Capacitor, Ceramic, 0.01µf M39014/1C-1455 100V 1V 0.01 0.0661 Capacitor, Ceramic, 0.1µf M39014/1C-i473 100V 15V 0.15 6.0088	[4	Capacitor, Ceramic, 0.01pf	M39014/1C-1455	1000	۸6	0.09	0.0062	2170
Capacitor, Ceramic, 0.1µf M39014/1C-i473 100V 15V 0.15 G.0008	(5)	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	10	0.01	0.0061	2170
	93	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	15V	0.15	0.0088	2170
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TABLE 4- 70

RF FRINTED WIRING BOARD RELIABILITY DATA

8. 8.5 9.	40°C)	P/N C314303, RE	REV. B			Page 3 of	6
RE F SYMBOL	PART OF SCRIPTION	PART NUMBER	RATED STRESS	APPLIED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
(2)	Capacitor, Ceramic, O.luf	M39014/1C-1473	100v	15V	0.15	0.0083	2170
83	Capacitor, Ceramic, 0.1 Uf	M39014/1C-1473	1000	15V	0.15	0.0088	2170
63	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	15V	0.15	0.0068	2170
010	Capacitor, Ceramic, $0.01_{ m P}$ f	M39014/1C-1455	1000	15V	0.15	0.0068	2170
CII	Capacitor, Ceramic, 0.01, f	M39014/1C-1455	1000	15V	0.15	0.0068	2170
C12	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	7.4	0.07	0.0061	2170
C13	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	100	0.10	0.0081	2170
C14	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	100	0.10	0.0063	2170
C15	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	20	0.02	0.0078	2170
616	Capacitor, Ceramic, 30pf	CCROSCGXXXJM	1000	100	0.10	0.0031	2170
(11)	Capacitor, Ceramic, 6800pf	CCR05CG682JM	1000	84	0.08	0.0058	2170
C18	Capacitor, Ceramic, 4700pf	CCROSCG472JM	1000	84	0.08	0.0055	2170
(19	Capacitor, Ceramic, Chip, 15pf	COR12BP150AJSM	200	101	0.20	0.0038	2170
C20	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	20	0.02	0.0078	2170
C21	Capacitor, Ceramic, 0.001µf	CCR05CG102JM	1000	۸0	00.00	0.0045	2170
C22	Capacitor, Ceramic, $0.01_{ m pf}$	M39014/1C-1455	1000	λ9	0.05	0.0061	2170
C23	Capacitor, Tantalum, 6.8µf	M39003/01-2304	35V	15V	0.43	0.1083	2170
C24	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	100v	100	0.10	0.0063	2170
C25	Capacitor, Ceramic, 0.15f	M39014/1C-1473	1000	54	0.05	0.0079	2170
626	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	100v	30	0.03	0.0078	2170
C27	Capacitor, Ceramic, 0.001µf	CCR05CG102JM	1000	Λ0	00.00	0.0045	2170
628	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	8.	0.05	0.0079	2170
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1			7	1	-		

TABLE 4-7C

RF FRINTED WIRING BOARD RELIABILITY DATA

*60** - 81678

и WS)	40°C)	P/N C314303, REV	EV. B		-	Page 4 of	9
RE I SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FATEURE	F.R. Source
623	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	5٧	0.05	0.0079	2170
0230	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	5٧	0.05	0.0079	2170
(31	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	20	0.05	0.0079	2170
(33	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	15V	0.15	0.0088	2170
C34	Capacitor, Ceramic, 60pF	CCROSCG680JM	1000	۸0	0.00	0.0032	2170
(35	Capacitor, Ceramic, 330pF	CCR05CG331JM	1000	۸0	0.00	0.0040	2170
983	Capacitor, Tantalum, 33µf	M39003/01-2304	100	5٧	0.50	0.1724	2170
(3)	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	15V	0.15	0.0088	2170
638	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	8	0.08	0.0080	2170
ຂ	Resistor, Fixed Film, 10KΩ	RNC50H1002FM	100mW	JE O	0.00	0.0073	2170
R2	Resistor, Fixed Film, 5.11KQ	RNC50H5111FM	100mW	SmW	0.05	0.0076	2170
83	Resistor, Fixed Film, 10KO	RNC50H1002FM	100mW	7mW	0.07	0.0078	2170
RA	Resistor, Fixed Film, 5100	RCR07G511KM	250mW	100mW	0.40	0.0000	2170
RS	Resistor, Fixed Film, 5.46Kg	RNC50H5461FM	100mW	10mW	0.10	0.0081	2170
R6	Resistor, Fixed Film, 7.5Kg	RNC50H7501FM	100mW	SmM	0.05	0.0076	2170
R7	Resistor, Fixed Film, 102	RNC50H10R0FM	100mW	12mW	0.12	0.0083	2170
RB	Resistor, fixed film, 2742	RNC50H2740FM	100mW	20mM	0.20	0.0091	2170
R9	Resistor, Fixed Film, 18.22	RNC50H18R2FM	100mW	50mW	0.50	0.0131	2170
R10	Resistor, Fixed Film, 274%	RNC50H2740FM	100mW	20mW	0.20	0.0091	2170
K11	Resistor, Fixed Film, 50%	RNC50HXXXXFM	100mW	5mW	0.05	0.0076	2170
F12	Pesistor, Fixed Film, 10K2	RNC50H1002FM	100mW	Оппм	00.00	0.0073	2170
P13	Resistor, Fixed Film, 1.5Kz	RNC50H1501FM	100mW	34mW	0.34	0.0108	2170
R14	Resistor, Fixed Film, 12182	RNC50H1213FM	100mW	JmW.	0.01	0.6780	2170
		L	7				

TABLE 4-7C

RF PRINTED WIRING BOARD RELIABILITY DATA

P/N C314303, REV.

(GM 3 40°C)

*60** - 81678

(CM & 40°C)	40-01					Page 5 of	9
REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAJLURE RATE	F.R. SOURCE
R15	Resistor, fixed Film, 3.01Kg	RNC50H3011FM	100mW	40mW	0.40	0.0116	2170
R16	Resistor, Fixed Film, 3.01Kg	RNC50H3011FM	100mW	40mM	0.40	0.0116	2170
R17	Resistor, fixed Film, 100KG	RNC50H1003FM	100mW	MmO	0.00	0.0073	2170
R1 8	Resistor, Fixed Film, 2KG	RNC50H2001FM	100mW	2mW	0.05	0.0073	2170
R19	Resistor, Fixed Film, 82.50	RNC50H82R5FM	100mW	4mV	0.04	0.0075	2170
R20	Resistor, Fixed Film, 7.5KA	RNC50H7501FM	100mW	J.M.	0.01	0.0073	2170
R21	Resistor, Fixed Film, 1000	RNC50H1000FM	100mW	3mk	0.03	0.0074	2170
R22	Resistor, Fixed Film, 4.7KA	RNC50H4751FM	100mW	1mW	0.01	0.0073	2170
R23	Resistor, Fixed Film, 4.7KG	RNC50H4751FM	100mW	JmM	0.01	0.0073	2170
R24	Resistor, Fixed Film, 33.20	RNCSOH33R2FM	100mW	20mW	0.20	0.0091	2170
R25	Resistor, Fixed Film, 6192	RNC55H6190FM	125mW	40mM	0.32	0.0106	2170
R26	Resistor, (Thermistor) 3.3KG	RTH42E5332K	100mW	2mM	0.05	2,6250	2170
R27	Resistor, Fixed Composition, 3010	RCR07G301KM	250mW	8mM	0.03	0.0042	2170
R29	Resistor, Fixed Film, 10KG	RNC50H1002FM	100mW	OmM	0.00	0.0073	2170
R30	Resistor, Fixed Film, 5000	RNC50H5000FM	100mW	Omit	0.00	0.0073	2170
R31	Resistor, Fixed Film, 7.5KA	RNC50H7501FM	100mW	7mW	0.07	0.0078	2170
R32	Resistor, Fixed Film, 475Ω	RNC50H4750FM	100mW	MEI	0.01	0.0073	2170
R33	Resistor, Fixed Film, 273	RNC50H27R0FM	100mW	2mW	0.05	0.0073	2170
۲۱	Crystal, 90MHz	A316630				0.2000	2170
=	Transformer, 90MHz (OUI)	8316778	105°C	ე.,65		0.4028	2170
12	Transformer, RF	SCD 316787	105°C	J.69		0.4028	2170
,	A POST OF THE PROPERTY OF THE	011	0	1.00.1		0007	ć
<u>.</u>	iranstormer, SMHZ (UUI)	8316//0	105°L	7 60		0.40,8	21/10

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RF PRINTED WIRING BOARD RELIABILITY DATA TABLE 4-7C

P/N C314303, REV. B

(GM @ 4	40°C)	F/N C314303, REV. B	n			Page 6 of	9
RF F SYMBOL	FART DESCRIPTION	PART NUMBER	RATED STRESS	APPLIED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
[1]	Inductor, Tuning	8316779	105°C	J°63		0.0283	2170
77	Inductor, 0.22µH	M39003/3	105°C	ე。69		0.0283	2170
		-AR22KM					
13	Inductor, 4.7µH	M39010/1	105°C	ე 65		0.0283	2170
		-A4R7KM					
14	Inductor, 15mH	M39010/3	105°C	ე。69		0.0283	2170
. —		-A153KM					
1.5	Inductor, 2.2mH	M39010/3	ງ°201	ე。69		0.0283	2170
		-A222KM					
91	Inductor, 470µH	M39010/3	105°C	ე。69		0.0283	2170
		-A471KM					
17	Inductor, 220µH	M39010/3	105°C	ე გ65		0.0283	2170
		-A221KM					
F.8	Inductor, 220µH	M39010/3	105°C	ე ₀ 69		0.0283	2170
		-A221KM				,	
11	Connector	SCD 316777				0.0857	2170
EI	Terminal (Qty. 9)	SCD 316774				0.1710	2170
	-						
PW81	Printed Wiring Bd (2-sided)					0.0903	2170
					10.10	137 7	

B-69

6.461 TOTAL

TABLE 4-8A SERVO PRINTED WIRING BOARD RELIABILITY DATA

_	(AUF @	2°C)	P/N C314300, REV.					40
+60+V · 8	REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL IED STRESS	STRESS RATIO	FAILURE RATE	
1678	01	IC, Linear, Op. Amp.	SCD 316786 (OP-14AZ/883B)	125°C	47°C		0.1823	
	U2	IC, Digital, Switch	J38510/05802BCC (CD4056BF)	150°C	21°C		0.0473	
	U3	IC, Digital, Flip-Flop	MIL-M-38510 (CD4013AJ)	150°C	30°C		0.0475	
	U4	IC, Linear, Comparator	LM139/883B	150°C	2°75		0.2090	
	01	Transistor, SI, J FET	2N5116/JANTX	500mW 200°C	Omw 20°C	0.00	0.2360	
	05	Transistor, SI, NPN	MIL-S-19500/255	400	300	0.75	0.0175	
			(2N2222A)	400mW	3mM	0.01		
				ວ。002	21°C		······································	_
	CR1	Diode, SI, GP	M1L-S-19500/116	100V	80	0.08	0.0013	
			(JANTX1N4148-1)	200mW	OmW	0.00	-	
				175°C	ວ_0ઽ			
	CR2	Diode, SI, Zener, 7.5V	M1L-S-1950G/127	400mW	75mW	0.19	0.0240	
			(JANTXIN755A-1)	175°C	43°C			
	CI	Capacitor, Ceramic, luf	M39014/2E-1407	200	10	0.02	0.0176	
	23	Capacitor, Ceramic, 33pf	M39014/1C-XXXX	100V	Λ0	00.0	0.0057	
	C3	Capacitor, Ceramic, 33pF	M39014/1C-XXXX	1000	00	0.00	0.0057	

ESSESSION DELICIONAL DELICIONAL DESCOSON TODO DEL TODO CONTRARAZIONAL DESCONO DESCOSON DESCOSON DESCOSON DESCO

TABLE 4-8A

SERVO PRINTED WIRING BOARD RELIABILITY DATA

| f.R.
SOURCE | 2170 | 2170 | 2170 | 2170 | 2170 | 2170

 | 2170 | 2170 | 2170 | 2170 | 2170

 | 2170 | 2170 | 2170
 | 2170 | 2170 | 2170 | 2170 | 2170 | 2170 | 2170
 | 2170 | 2170 | |
|--------------------|--|--|---|--|--
--
--
--|---|---|--|---
--
---|--
---|--|--|--|---|--|---
---|---|---|---|--|
| FAILURE
RATE | 0.0176 | 0.0154 | 0.0179 | 0.0176 | 0.0246 | 0.0000

 | 0.0273 | 0.0273 | 0.3138 | 0.0154 | 0.0108

 | 0.0143 | 0.3294 | 0.3294
 | 0.0133 | 0.0133 | 0.0133 | 0.0133 | 0.0146 | 0.0146 | 0.0133
 | 0.0133 | 0.0133 | |
| STRFSS
RATIO | 0.00 | 0.15 | 0.08 | 0.00 | 0.22 | 0.16

 | 0.30 | 0.30 | 0.43 | 0.15 | 0.08

 | 0.11 | 0.43 | 0.43
 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00
 | 00.00 | 0.00 | |
| APPL IED
STRESS | ۸0 | 15V | 4 | Λ0 | 110 | 88

 | 150 | 15V | 15V | 15V | 80

 | 110 | 15V | 150
 | OmM | Omit | Omk | Omik | <u>*</u> | Omi | Omk
 | Mun() | OmM | |
| RATED
STRESS | 50v | 1000 | 200 | 200 | 200 | 200

 | 1000 | 1000 | 350 | 1000 | 1000

 | 1000 | 35V | 35V
 | 100mW | 100mW | 100mW | 100mW | 100mW | 100mW | 100mW
 | 100mW | 100mm | |
| PARI NUMBER | M39014/2E-1407 | M39014/1C-1473 | M39014/2E-1407 | M39014/2E-1407 | M39014/2E-1407 | CCR06CG103JM

 | M39014/1C-1473 | M39014/1C-1473 | M39003/01-2304 | M39014/1C-1473 | M39014/1C-1455

 | M39014/1C-1473 | M39003/01-2304 | M39003/01-2304
 | RNC50H1002FM | RNC50H1002FM | RNC50H1002FM | RNC50H2002FM | RNC50H4993FM | RNC50H4993FM | RNC50H2002FM
 | RNC50H1002FM | RNC50H1002FM | |
| PART DESCRIPTION | Capacitor, Ceramic, luf | Capacitor, Ceramic, 0.1µf | Capacitor, Ceramic, luf | Capacitor, Ceramic, luf | Capacitor, Ceramic, luf | Capacitor, Ceramic, 0.01µf

 | Capacitor, Ceramic, 0.10µf | Capacitor, Ceramic, 0.1µF | Capacitor, Tantalum, 10µf | Capacitor, Ceramic, 0.1µf | Capacitor, Ceramic, 0.01µf

 | Capacitor, Ceramic, 0.1µf | Capacitor, Tantalum, 15µf | Capacitor, Tantalum, 15µf
 | Resistor, Fixed Film, $10 \mathrm{K}\Omega$ | Resistor, Fixed Film, $10 \mathrm{K}\Omega$ | Resistor, Fixed Film, $10 \mathrm{K}\Omega$ | Resistor, Fixed Film, 20KB | Resistor, Fixed Film, 499KΩ | Resistor, Fixed Film, 499KD | Resistor, fixed Film, 20KD
 | Resistor, Fixed Film, 10Ka | Resistor, Fixed Film, 10KΩ | |
| REF
SYMBOL | C4 | 53 | 93 | 73 | 83 | 63

 | 010 | C111 | C12 | C13 | C14

 | C15 | 913 | (117
 | R1 | R2 | R3 | R4 | 85 | R6 | R7
 | 83 | . 6м | |
| | REF PART DESCRIPTION PART NUMBER STRESS FALLURE STRESS FALLURE | REF PART DESCRIPTION PART NUMBER RATED STRESS FALLURE RATIO SYMBOL STRESS SIRESS RATIO RATE C4 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.00 0.0176 3 | REF PART DESCRIPTION PART NUMBER RATED APPLIED STRESS FAILURE SYMBOL CAPPLIED STRESS STRESS FAILURE C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50v 0v 0.00 0.0176 3 C5 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100v 15v 0.15 0.0154 3 | EF PART DESCRIPTION FART NUMBER RATED STRESS STRESS FALLURE RATE Capacitor, Ceramic, 1μf M39014/2E-1407 50V 0V 0.00 0.0176 3 Capacitor, Ceramic, 1μf M39014/1C-1473 100V 15V 0.15 0.0154 3 Capacitor, Ceramic, 1μf M39014/2E-1407 50V 4V 0.08 0.0179 3 | REF PART DESCRIPTION PART NUMBER RATIFD STRESS STRESS FALLURE RATE C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 | REF PART DESCRIPTION PART NUMBER RATED STRESS STRESS FAILURE RATED STRESS <td>REF PART DESCRIPTION PART NUMBER RATED STRESS STRESS FALLURE RATE C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0154 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.01µf CCRO6CG103JM 50V 8V 0.16 0.0090</td> <td>REF PART DESCRIPTION PART NUMBER RATIFD STRESS STRESS FALLURE RATIE SYMBOL Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.01µf CCR06CG103JM 50V 8V 0.16 0.0090 C10 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.023</td> <td>REF PART DESCRIPTION PART NUMBER RATED STRESS STRESS FAILURE RATE C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0154 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.01µf M39014/1C-1407 50V 8V 0.16 0.0090 C10 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.0273</td> <td>Rff PART DESCRIPTIOH PART NUMBER RAIFO SIRESS STRESS STRESS FAILURE RAIT C4 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, luf M39014/1C-1473 100V 15V 0.05 0.0154 C6 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, luf M39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.1bf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1bf M39003/01-2304 35V 15V 0.43 0.3138</td> <td>REF PART DESCRIPTION PART NUMBER RAITED STRESS STRESS FARIOR FARIUME C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0154 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 11V 0.22 0.0246 C8 Capacitor, Ceramic, 0.01µf M39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Tantalum, 10µf M39003/01-2304 35V 15V 0.43 0.0154 C12 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.43 0.0154 <td>REF PART DESCRIPTION PART NUMBER RAIFO STRESS STRESS STRESS FABLURE STRIURE FABLURE STRESS FABLURE STREES FAB</td><td>REF PART DESCRIPTION PART NUMBER RATED STRESS STRESS STRESS FALLUNE C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C9 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.1µf M39003/01-2304 35V 15V 0.43 0.318 C11 Capacitor, Ceramic, 0.1µf M39003/01-2304 35V 15V 0.43 0.318 C12 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.43 0.0164</td><td>REF PART DESCRIPTION PART NUMBER RAIFO STRESS STRESS FAILUR C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 0.1µf M39014/2E-1407 50V 4V 0.05 0.0179 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 0.01µf M39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.30 0.0273 C12 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.13 0.018 C13</td><td>REF PART DESCRIPTION PART NUMBER RANTOS STRESS STRESS FARLURE C4 Capacitor, Ceramic, 1µf
M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0179 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C9 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.15 0.0184 C12 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.03 0.0184 C15</td><td>REF PART DESCRIPTION FART NUMBER RATIO
STRESS RATIO
STRESS FALLURE
STRESS FALLURE
STRESS</td><td>REF Capacitor, Ceramic, 1uf HABI NUMBER SIRESS SIRESS FAILURE C4 Capacitor, Ceramic, 1uf H39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1uf H39014/2E-1407 50V 0V 0.00 0.0176 C6 Capacitor, Ceramic, 1uf H39014/2E-1407 50V 0V 0.00 0.0176 C7 Capacitor, Ceramic, 1uf H39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 1uf H39014/2E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 1uf H39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.1uf H39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1uf H39014/1C-1473 100V 15V 0.43 0.018 C12 Capacitor, Ceramic, 0.1uf H39014/1C-1473 100V 18V 0.03 0.018 C13 Capacitor, Cera</td><td>REF PART DESCRIPTION FART NUMBER RAITO STRESS STRESS STRESS STRESS STRESS STRESS FARTURE C4 Capacitor, Ceramic, 1µf M39014/2c-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2c-1407 50V 4V 0.08 0.0154 C6 Capacitor, Ceramic, 1µf M39014/2c-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2c-1407 50V 4V 0.08 0.0179 C8 Capacitor, Ceramic, 0.01µf M39014/2c-1407 50V W 0.08 0.0176 C10 Capacitor, Ceramic, 0.01µf M39014/1c-1473 100V 15V 0.0273 C11 Capacitor, Ceramic, 0.01µf M39014/1c-1473 100V 15V 0.016 0.0050 C12 Capacitor, Ceramic, 0.1µf M39014/1c-1473 100V 15V 0.016 0.0184 C13 Capacitor, Ceramic, 0.1µf M39014/1c-1473 100V 15V 0.018</td><td>REF PART DESCRIPTION PART NUMBER RATED STRESS FAPT LIED STRESS FATIUR SYMBOL Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 0.hf M39014/2E-1407 50V 0V 0.05 0.0154 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.06 0.0154 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0179 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.13 0.0154 C12 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.13 0.0154 C13 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.03 0.016</td><td>REF PART DESCRIPTION PART NUMBER RATED STRESS FATLUR CAD O.01 O.016 C.0176 C.</td><td>REF Capacitor, Ceramic, 1uf PARI NUMBER RATIO APPLIED STRESS FAILURE C4 Capacitor, Ceramic, 1uf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1uf M39014/1C-1473 100V 15V 0.05 0.0154 C6 Capacitor, Ceramic, 0.1uf M39014/1C-1407 50V 0V 0.08 0.0179 C7 Capacitor, Ceramic, 1uf M39014/2E-1407 50V 0V 0.08 0.0179 C9 Capacitor, Ceramic, 0.1uf M39014/1C-1473 100V 11V 0.22 0.0246 C10 Capacitor, Ceramic, 0.1uf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1uf M39014/1C-1473 100V 15V 0.18 0.018 C13 Capacitor, Ceramic, 0.1uf M39014/1C-1473 100V 15V 0.03 0.018 C13 Capacitor, Fixed Film, 10KG M39014/1C-1473 100V 15V 0.03 0.018 <t< td=""><td>REF Capacitor, Ceramic, 1µf PART NUMBER RATIED STRESS FALIED FALIER C4 Capacitor, Ceramic, 1µf H39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf H39014/1C-1473 100V 15V 0.015 0.0176 C6 Capacitor, Ceramic, 1µf H39014/1C-1407 50V 0V 0.00 0.0176 C7 Capacitor, Ceramic, 1µf H39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 0.1µf H39014/2E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.023 0.0273 C10 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.16 0.0176 C11 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.023 0.023 C11 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.03 0.0184 C</td><td>Rff PART DESCRIPTION PART NUMBER RATIED STRESS FAILURE C4 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.005 0.0176 C5 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.015 0.0176 C6 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0176 C7 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0176 C8 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0176 C9 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.22 0.0246 C11 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.30 0.0273 C12 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.03 0.0154 C13 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.03 0.0154 C13 Capacitor,</td><td>Rff PART DESCRIPTION PART NUMBER RATIFD STRESS SALIDS FALIURE C4 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.015 0.0176 C6 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.00 0.0176 C7 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.02 0.0273 C11 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.01 0.0154 C12 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.03 0.0154 C13 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.03 0.0154
 C13</td></t<></td></td> | REF PART DESCRIPTION PART NUMBER RATED STRESS STRESS FALLURE RATE C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0154 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.01µf CCRO6CG103JM 50V 8V 0.16 0.0090 | REF PART DESCRIPTION PART NUMBER RATIFD STRESS STRESS FALLURE RATIE SYMBOL Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.01µf CCR06CG103JM 50V 8V 0.16 0.0090 C10 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.023 | REF PART DESCRIPTION PART NUMBER RATED STRESS STRESS FAILURE RATE C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0154 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.01µf M39014/1C-1407 50V 8V 0.16 0.0090 C10 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.0273 | Rff PART DESCRIPTIOH PART NUMBER RAIFO SIRESS STRESS STRESS FAILURE RAIT C4 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, luf M39014/1C-1473 100V 15V 0.05 0.0154 C6 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, luf M39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.1bf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1bf M39003/01-2304 35V 15V 0.43 0.3138 | REF PART DESCRIPTION PART NUMBER RAITED STRESS STRESS FARIOR FARIUME C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0154 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 11V 0.22 0.0246 C8 Capacitor, Ceramic, 0.01µf M39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Tantalum, 10µf M39003/01-2304 35V 15V 0.43 0.0154 C12 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.43 0.0154 <td>REF PART DESCRIPTION PART NUMBER RAIFO STRESS STRESS STRESS FABLURE STRIURE FABLURE STRESS FABLURE STREES FAB</td> <td>REF PART DESCRIPTION PART NUMBER RATED STRESS STRESS STRESS FALLUNE C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C9 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.1µf M39003/01-2304 35V 15V 0.43 0.318 C11 Capacitor, Ceramic, 0.1µf M39003/01-2304 35V 15V 0.43 0.318 C12 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.43 0.0164</td> <td>REF PART DESCRIPTION PART NUMBER RAIFO STRESS STRESS FAILUR C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 0.1µf M39014/2E-1407 50V 4V 0.05 0.0179 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 0.01µf M39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.30 0.0273 C12 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.13 0.018 C13</td> <td>REF PART DESCRIPTION PART NUMBER RANTOS STRESS STRESS FARLURE C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0179 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C9 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.15 0.0184 C12 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.03 0.0184 C15</td> <td>REF PART DESCRIPTION FART NUMBER RATIO
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50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.1uf H39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1uf H39014/1C-1473 100V 15V 0.43 0.018 C12 Capacitor, Ceramic, 0.1uf H39014/1C-1473 100V 18V 0.03 0.018 C13 Capacitor, Cera</td> <td>REF PART DESCRIPTION FART NUMBER RAITO STRESS STRESS STRESS STRESS STRESS STRESS FARTURE C4 Capacitor, Ceramic, 1µf M39014/2c-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2c-1407 50V 4V 0.08 0.0154 C6 Capacitor, Ceramic, 1µf M39014/2c-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2c-1407 50V 4V 0.08 0.0179 C8 Capacitor, Ceramic, 0.01µf M39014/2c-1407 50V W 0.08 0.0176 C10 Capacitor, Ceramic, 0.01µf M39014/1c-1473 100V 15V 0.0273 C11 Capacitor, Ceramic, 0.01µf M39014/1c-1473 100V 15V 0.016 0.0050 C12 Capacitor, Ceramic, 0.1µf M39014/1c-1473 100V 15V 0.016 0.0184 C13 Capacitor, Ceramic, 0.1µf M39014/1c-1473 100V 15V 0.018</td> <td>REF PART DESCRIPTION PART NUMBER RATED STRESS FAPT LIED STRESS FATIUR SYMBOL Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 0.hf M39014/2E-1407 50V 0V 0.05 0.0154 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.06 0.0154 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0179 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.13 0.0154 C12 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.13 0.0154 C13 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.03 0.016</td> <td>REF PART DESCRIPTION PART NUMBER RATED STRESS FATLUR CAD O.01 O.016 C.0176 C.</td> <td>REF Capacitor, Ceramic, 1uf PARI NUMBER RATIO APPLIED STRESS FAILURE C4 Capacitor, Ceramic, 1uf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1uf M39014/1C-1473 100V 15V 0.05 0.0154 C6 Capacitor, Ceramic, 0.1uf M39014/1C-1407 50V 0V 0.08 0.0179 C7 Capacitor, Ceramic, 1uf M39014/2E-1407 50V 0V 0.08 0.0179 C9 Capacitor, Ceramic, 0.1uf M39014/1C-1473 100V 11V 0.22 0.0246 C10 Capacitor, Ceramic, 0.1uf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1uf M39014/1C-1473 100V 15V 0.18 0.018 C13 Capacitor, Ceramic, 0.1uf M39014/1C-1473 100V 15V 0.03 0.018 C13 Capacitor, Fixed Film, 10KG M39014/1C-1473 100V 15V 0.03 0.018 <t< td=""><td>REF Capacitor, Ceramic, 1µf PART NUMBER RATIED STRESS FALIED FALIER C4 Capacitor, Ceramic, 1µf H39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf H39014/1C-1473 100V 15V 0.015 0.0176 C6 Capacitor, Ceramic, 1µf H39014/1C-1407 50V 0V 0.00 0.0176 C7 Capacitor, Ceramic, 1µf H39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 0.1µf H39014/2E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.023 0.0273 C10 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.16 0.0176 C11 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.023 0.023 C11 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.03 0.0184 C</td><td>Rff PART DESCRIPTION PART NUMBER RATIED STRESS FAILURE C4 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.005 0.0176 C5 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.015 0.0176 C6 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0176 C7 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0176 C8 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0176 C9 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.22 0.0246 C11 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.30 0.0273 C12 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.03 0.0154 C13 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.03 0.0154 C13 Capacitor,</td><td>Rff PART DESCRIPTION PART NUMBER RATIFD STRESS SALIDS FALIURE C4 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.015 0.0176 C6 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.00 0.0176 C7 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.02 0.0273 C11 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.01 0.0154 C12 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.03 0.0154 C13 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.03 0.0154 C13</td></t<></td> | REF PART DESCRIPTION PART NUMBER RAIFO STRESS STRESS STRESS FABLURE STRIURE FABLURE STRESS FABLURE STREES FAB | REF PART DESCRIPTION PART NUMBER RATED STRESS STRESS STRESS FALLUNE C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C9 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.1µf M39003/01-2304 35V 15V 0.43 0.318 C11 Capacitor, Ceramic, 0.1µf M39003/01-2304 35V 15V 0.43 0.318 C12 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.43 0.0164 | REF PART DESCRIPTION PART NUMBER RAIFO STRESS STRESS FAILUR C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 0.1µf M39014/2E-1407 50V 4V 0.05 0.0179 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V
 0.00 0.0176 C8 Capacitor, Ceramic, 0.01µf M39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.10µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.30 0.0273 C12 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.13 0.018 C13 | REF PART DESCRIPTION PART NUMBER RANTOS STRESS STRESS FARLURE C4 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0179 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 4V 0.08 0.0176 C9 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.30 0.0273 C10 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.15 0.0184 C12 Capacitor, Ceramic, 0.1µf M39014/1C-1473 100V 15V 0.03 0.0184 C15 | REF PART DESCRIPTION FART NUMBER RATIO
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STRESS | REF Capacitor, Ceramic, 1uf HABI NUMBER SIRESS SIRESS FAILURE C4 Capacitor, Ceramic, 1uf H39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1uf H39014/2E-1407 50V 0V 0.00 0.0176 C6 Capacitor, Ceramic, 1uf H39014/2E-1407 50V 0V 0.00 0.0176 C7 Capacitor, Ceramic, 1uf H39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 1uf H39014/2E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 1uf H39014/2E-1407 50V 11V 0.22 0.0246 C9 Capacitor, Ceramic, 0.1uf H39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1uf H39014/1C-1473 100V 15V 0.43 0.018 C12 Capacitor, Ceramic, 0.1uf H39014/1C-1473 100V 18V 0.03 0.018 C13 Capacitor, Cera | REF PART DESCRIPTION FART NUMBER RAITO STRESS STRESS STRESS STRESS STRESS STRESS FARTURE C4 Capacitor, Ceramic, 1µf M39014/2c-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf M39014/2c-1407 50V 4V 0.08 0.0154 C6 Capacitor, Ceramic, 1µf M39014/2c-1407 50V 4V 0.08 0.0179 C7 Capacitor, Ceramic, 1µf M39014/2c-1407 50V 4V 0.08 0.0179 C8 Capacitor, Ceramic, 0.01µf M39014/2c-1407 50V W 0.08 0.0176 C10 Capacitor, Ceramic, 0.01µf M39014/1c-1473 100V 15V 0.0273 C11 Capacitor, Ceramic, 0.01µf M39014/1c-1473 100V 15V 0.016 0.0050 C12 Capacitor, Ceramic, 0.1µf M39014/1c-1473 100V 15V 0.016 0.0184 C13 Capacitor, Ceramic, 0.1µf M39014/1c-1473 100V 15V 0.018 | REF PART DESCRIPTION PART NUMBER RATED STRESS FAPT LIED STRESS FATIUR SYMBOL Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 0.hf M39014/2E-1407 50V 0V 0.05 0.0154 C6 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.06 0.0154 C7 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0179 C8 Capacitor, Ceramic, 1µf M39014/2E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.13 0.0154 C12 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.13 0.0154 C13 Capacitor, Ceramic, 0.01µf M39014/1C-1473 100V 15V 0.03 0.016 | REF PART DESCRIPTION PART NUMBER RATED STRESS FATLUR CAD O.01 O.016 C.0176 C. | REF Capacitor, Ceramic, 1uf PARI NUMBER RATIO APPLIED STRESS FAILURE C4 Capacitor, Ceramic, 1uf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1uf M39014/1C-1473 100V 15V 0.05 0.0154 C6 Capacitor, Ceramic, 0.1uf M39014/1C-1407 50V 0V 0.08 0.0179 C7 Capacitor, Ceramic, 1uf M39014/2E-1407 50V 0V 0.08 0.0179 C9 Capacitor, Ceramic, 0.1uf M39014/1C-1473 100V 11V 0.22 0.0246 C10 Capacitor, Ceramic, 0.1uf M39014/1C-1473 100V 15V 0.30 0.0273 C11 Capacitor, Ceramic, 0.1uf M39014/1C-1473 100V 15V 0.18 0.018 C13 Capacitor, Ceramic, 0.1uf M39014/1C-1473 100V 15V 0.03 0.018 C13 Capacitor, Fixed Film, 10KG M39014/1C-1473 100V 15V 0.03 0.018 <t< td=""><td>REF Capacitor, Ceramic, 1µf PART NUMBER RATIED STRESS FALIED FALIER C4 Capacitor, Ceramic, 1µf H39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf H39014/1C-1473 100V 15V 0.015 0.0176 C6 Capacitor, Ceramic, 1µf H39014/1C-1407 50V 0V 0.00 0.0176 C7 Capacitor, Ceramic, 1µf H39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 0.1µf H39014/2E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.023 0.0273 C10 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.16 0.0176 C11 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.023 0.023 C11 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.03 0.0184 C</td><td>Rff PART DESCRIPTION PART NUMBER RATIED STRESS FAILURE C4 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.005 0.0176 C5 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.015 0.0176 C6 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0176 C7 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0176 C8 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0176 C9 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.22 0.0246 C11 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.30 0.0273 C12 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.03 0.0154 C13 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.03 0.0154 C13 Capacitor,</td><td>Rff PART DESCRIPTION PART NUMBER RATIFD STRESS SALIDS FALIURE C4 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.015 0.0176 C6 Capacitor, Ceramic, luf M39014/1E-1407 50V
0V 0.00 0.0176 C7 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.02 0.0273 C11 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.01 0.0154 C12 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.03 0.0154 C13 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.03 0.0154 C13</td></t<> | REF Capacitor, Ceramic, 1µf PART NUMBER RATIED STRESS FALIED FALIER C4 Capacitor, Ceramic, 1µf H39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, 1µf H39014/1C-1473 100V 15V 0.015 0.0176 C6 Capacitor, Ceramic, 1µf H39014/1C-1407 50V 0V 0.00 0.0176 C7 Capacitor, Ceramic, 1µf H39014/2E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, 0.1µf H39014/2E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.023 0.0273 C10 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.16 0.0176 C11 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.023 0.023 C11 Capacitor, Ceramic, 0.1µf H39014/1C-1473 100V 15V 0.03 0.0184 C | Rff PART DESCRIPTION PART NUMBER RATIED STRESS FAILURE C4 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.005 0.0176 C5 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.015 0.0176 C6 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0176 C7 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0176 C8 Capacitor, Ceramic, luf M39014/2E-1407 50V 4V 0.08 0.0176 C9 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.22 0.0246 C11 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.30 0.0273 C12 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.03 0.0154 C13 Capacitor, Ceramic, 0.0luf M39014/1C-1473 100V 15V 0.03 0.0154 C13 Capacitor, | Rff PART DESCRIPTION PART NUMBER RATIFD STRESS SALIDS FALIURE C4 Capacitor, Ceramic, luf M39014/2E-1407 50V 0V 0.00 0.0176 C5 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.015 0.0176 C6 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.00 0.0176 C7 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.00 0.0176 C8 Capacitor, Ceramic, luf M39014/1E-1407 50V 0V 0.00 0.0176 C9 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.02 0.0273 C11 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.01 0.0154 C12 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.03 0.0154 C13 Capacitor, Ceramic, 0.0luf M39014/1E-1473 100V 15V 0.03 0.0154 C13 |

TABLE 4-8A
SEPVO PRINTED WIRING BOARD RELIABILITY DATA

	(AUF @	SEPVO 2°C)	SEPVO FRINTED WIRING BOARD RELIABILITY DATA P/N C314300, REV.	KELIABILI SV.	TY DATA		Sheet 3 of	4	
+60+*	REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL JED STRESS	STRESS RATIO	FATEURE RATE	1	
1670	R10	Resistor, Fixed Film, 100KD	RNC50H1003FM	100mW	Omiv	0.00	0.0133	2170	
	RII	Resistor, Fixed Film, 100K2	RNCSOH1003FM	100mW	Omik	0.00	0.0133	2170	
	R12	Resistor, Fixed Film, 10KD	RNC50H1002FM	100mW	AMO.	0.00	0.0133	2170	
	R13	Resistor, Fixed Film, 3.01KG	RNC50H3011FM	100mW	Omk	0.00	0.0133	2170	
	R14	Resistor, Fixed Film, 50KA	RNC50H5002FM	100mW	Omik	0.00	0.0133	2170	
	R15	Resistor, Fixed Film, 100Ku	RNC50H1003FM	100mW	NIE O	0.00	0.0133	2170	
	R16	Resistor, Fixed Film, 24KQ	RNC50HXXXXFM	100mW	3mK	0.03	0.0136	2170	
	R17	Resistor, Fixed Film, 4.99KA	RNC50H4991FM	100mW	AEO	0.00	0.0133	2170	
R	R18	Resistor, Fixed Film, 1.5KQ	RNC55H1501FM	125mW	38mW	0.30	0.0182	2170	
77	R19	Resistor, Fixed Film, 302	RNC50HXXXXFM	100mW	33.	0.03	0.0136	2170	
·	R24	Resistor, fixed Film, 100Kg	RNC50H1003FM	100mW	Je I	0.01	0.0133	2170	
	R25	Resistor, fixed film, 49.9Kg	RNC50H4991FM	100mW	Omin	0.00	0.0133	2170	
_	R26	Resistor, Fixed Film, 698KD	RNC50H6983FM	100mW	AE O	0.00	0.0146	2170	
	R27	Resistor, Fixed Film, 100KΩ	RNC50H1003FM	100mW	JE!	0.01	0.0133	2170	
	R28	Resistor, fixed Film, 62KM	RNC50H6202FM	100mW	OmM	0.00	0.0133	2170	
	R29	Resistor, fixed film, 3.01Kg	RNC50H3011FM	100mW	37mW	0.37	0.0196	2170	
	R 30	Resistor, Fixed Film, 3.01Kg	RNCSOH3011FM	100mW	3mM	0.03	0.0136	2170	
	R31	Resistor, Fixed Film, 10K2	RNCSOH1002FM	100mW	23mW	0.23	0.0168	2170	
	R32	Resistor, fixed film, 3.01Ku	RNC50H3011FM	100mW	Omit	00.00	0.0133	2170	
	R33	Resistor, Fixed Film, 3.01Kg	RNC50H3011FM	100mW	Omik	0.00	0.0133	2170	
	R34	Resistor, Fixed Film, 11.3k.	RNC50H1132FM	100mW	1 1mW	0.11	0.0148	2170	
	R35	Resistor, Fixed Film, 1015.	RNC50H1002FM	100mW	Omik	00.00	0.0133	2170	
_	R36	Resistor, fixed film, 100K.	RNC50H1003FM	100m₩	2mW	0.05	0.0134	2170	
1	1			1			1	1	

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TABLE 4-8A

MANAGOR CHACCE TOTAL SECTION COCCOOL MANAGEMENT

SERVO PRINTED WIRING BOARD RELIABILITY DATA

	(AUF @	2°C)	P/N C314300, R	REV.			Sheet 4 of	4
94097 E	REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAILURE RATE	F.R. Source
	R37	Resistor, Fixed Film, 3.4KD	RNC50HXXXXFM	100mW	OmW	00.00	0.0133	2170
	R38	Resistor, Fixed Film, 3.01KA	RNC50H3011FM	100mW	OmM	0.00	0.0133	2170
	R39	Resistor, Fixed Film, 3.01KA	RNC50H3011FM	100mW	AEO.	0.00	0.0133	2170
	R40	Resistor, Fixed Film, 20Kn	RNC50H2002FM	100mW	- MWO	0.00	0.0133	2170
	R41	Resistor, Fixed Film, 3.01KA	RNC50H3011FM	100mW	JE I	0.01	0.0133	2170
		Inductor, 220µH	M39010/3	ງ ູ \$01	30°C		0.0043	2170
			-AA21KM					
	12	Inductor, 220µH	M39010/2	ງ°201	30°C		0.0043	2170
			-AA21KM					-
	El	Terminal (Qty. 17)	SCD 316774		-		0.4199	2170
	PWB1	Printed Wiring Bd. (2-s1ded)	D314300				0.2712	2170
	T				T		1	

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TABLE 4-8B SERVO PRINTED WIRING BOARD RELIABILITY DATA

_	(GF @ 30	30°C	P/N C314300, REV	٠٧.			Sheet 1 of	f 4
****	RE F SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
<u></u>	15	IC, Linear, Op. Amp.	SCD 316786 (0P-14AZ/8838)	125°C	75°C		0.2758	2170
	N2	IC, Digital, Switch	J38510/05802BCC (CD4056BF)	150°C	49°C		0.0147	2170
	n3	IC, Digital, Flip-Flop	M1L-M-38510 (C04013AJ)	150°C	ა.89		0.0162	2170
	04	IC, Linear, Comparator	LM139/8838	150℃	ე, 55		0.1208	2170
	10	Transistor, SI, J FET	2N5116/JANTX	200°C	Omiv 48°C	0.00	0.0206	2170
	20	Transistor, SI, NPN	MIL-S-19500/255 (2N2222A)	40V 400mW	30V 3mW	0.75	0.0022	2170
	CR1	Diode, SI, GP	MIL-S-19500/116 (JANTX1N4148-1)	200°C 100V 200mW	49°C 8V OmW	0.08	0.0002	2170
 	CR2	Diode, SI, Zener, 7.5V	MIL-S-19500/127 (JANTXIN755A-1)	175°C 400mW 175°C	48°C 75mW 71°C	0.19	0.0017	2170
	C3	Capacitor, Ceramic, luf Capacitor, Ceramic, 33pf Capacitor, Ceramic, 33pf	M39014/2E-1407 M39014/1C-XXXX M39014/1C-XXXX	50v 100v 100v	00 OV	0.00	0.0020	2170 2170 2170

TABLE 4-8B

SERVO FRINTED WIRING BOARD RELIABILITY DATA

4	F.R. SOURCE	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	!
Sheet 2 of	FAILURE RATE	0.0020	0.0018	0.0021	0.0020	0.0028	0.0013	0.0031	0.0031	0.0310	0.0018	0.0012	0.0016	0.0325	0.0325	0.0020	0.0020	0.0000	0.0020	0.0022	0.0022	0.0020	0.0020	0.0020	
	STRESS RATIO	0.00	0.15	0.08	0.00	0.22	0.16	0.30	0.30	0.43	0.15	0.08	0.11	0.43	0.43	000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	APPL 1ED STRESS	00	150	4	۸٥	114	84	15V	150	150	150	88	110	15V	150	MmO	MmO	Mm0	M₩O	OmW	Omin	M:EO	Omit	Mill()	
۷.	RATED STRESS	500	1000	200	200	504	200	1000	1000	35V	1000	1000	1000	35V	357	100mW	100mW	100mW	100mW	100mW	160mW	100mW	100mW	100mW	
P/N C314300, REV.	PART NUMBER.	M39014/2E-1407	M39014/1C-1473	M39014/2E-1407	M39014/2E-1407	M39014/2E-1407	CCR06CG103JM	M39014/1C-1473	M39014/1C-1473	M39003/01-2304	M39014/1C-1473	M39014/1C-1455	M39014/1C-1473	M39003/01-2304	M39003/01-2304	RNC50H1002FM	RNC50H1002FM	RNC50H1002FM	RNCSOH2002FM	RNC50H4993FM	RNC50H4993FM	RNCSOH2002FM	RNC50H1002FM	RNC50H1002FM	
30°C)	PART DESCRIPTION	Capacitor, Ceramic, luf	Capacitor, Ceramic, 0.1µf	Capacitor, Ceramic, 1µf	Capacitor, Ceramic, luf	Capacitor, Ceramic, luf	Capacitor, Ceramic, 0.01µf	Capacitor, Ceramic, 0.10µf	Capacitor, Ceramic, $0.1\mu F$	Capacitor, Tantalum, 10µf	Capacitor, Ceramic, 0.1µf	Capacitor, Ceramic, 0.01µf	Capacitor, Ceramic, 0.1µf	Capacitor, Tantalum, 15 _µ f	Capacitor, Tantalum, 15µf	Resistor, Fixed Film, 10KΩ	Resistor, Fixed Film, 10K2	Resistor, Fixed Film, 10KB	Resistor, Fixed Film, 20K2	Resistor, Fixed Film, 499K2	Resistor, fixed film, 499Ku	Resistor, Fixed Film, 20KM	Resistor, Fixed Film, 10K2	Resistor, Fixed Film, 10KG	
(GF @ 3C	REF SYMBOL	50	5	93	C2	83	63	C10	C113	C12	C13	C14	C15	016	C17	2	R2	R3	R4	RS	Ж6	R.7	К8	R9	

TABLE 4-8B SERVO PRINTED WIRING BOARD RELIABILITY DATA

#60## - 81678

(GF @ 3	30°C)	P/N C314300, REV	۸.			Sheet 3 of	4
REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
R10	Resistor, Fixed Film, 100Ku	RNC50H1003FM	100mW	Omik	0.00	0.0020	2170
R11	Resistor, Fixed Film, 100KΩ	RNC50H1003FM	100mW	Omiw	0.00	0.0020	2170
R12	Resistor, Fixed Film, 10KD	RNC50H1002FM	100mW	Omin	0.00	0.0020	2170
R13	Resistor, Fixed Film, 3.01Kn	RNC50H3011FM	100mW	Omin	0.00	0.0020	2170
R14	Resistor, Fixed Film, 50K2	RNC50H5002FM	100mW	Omp	0.00	0.0020	2170
R15	Resistor, Fixed Film, 100KQ	RNC50H1003FM	100mW	Omin	0.00	0.0020	2170
R16	Resistor, Fixed Film, 24KQ	RNC50HXXXXFM	100mW	3mM	0.03	0.0021	2170
R17	Resistor, Fixed Film, 4.99KA	RNC50H4991FM	100ш	Omin	0.00	0.0020	2170
R18	Resistor, Fixed Film, 1.5KA	RNC55H1501FM	125mW	38mW	0.30	0.0029	2170
R19	Resistor, Fixed Film, 300	RNC50HXXXXFM	100mk	3mW	0.03	0.0021	2170
R24	Resistor, Fixed Film, 100KB	RNC50H1003FM	100mW	lmW	0.01	0.0020	2170
R25	Resistor, Fixed Film, 49.9Kg	RNC50H4991FM	100mW	Mino	0.00	0.000.0	2170
R26	Resistor, Fixed Film, 698KD	RNC50H6983FM	100mW	OmM	0.00	0.0022	2170
R27	Resistor, Fixed Film, 100KΩ	RNC50H1003FM	100ml	lmW	0.01	0.0020	2170
R28	Resistor, fixed Film, 62KA	RNC50H6202FM	100™	OmM	0.00	0.0020	2170
R29	Resistor, Fixed Film, 3.01KG	RNC50H3011FM	100mW	37mW	0.37	0.0031	2170
R30	Resistor, Fixed Film, 3.01KB	RNC50H3011FM	100m₩	3mk	0.03	0.0021	2170
R31	Resistor, Fixed Film, 10K2	RNC50H1002FM	100mW	2.3mW	0.23	0.0026	2170
R32	Resistor, Fixed Film, 3.01K2	RNC50H3011FM	100mW	MuO	00.00	0.00.0	2170
R33	Resistor, Fixed Film, 3.01Kg	RNC50H3011FM	100mW	OmiM	00.00	0.000.0	2170
R34	Resistor, fixed film, 11.3K2	RNC50H1132FM	100mW] JmW	0.11	0.0023	2170
R35	Resistor, Fixed Film, 10Ku	RNC50H1002FM	100mW	MunO	00.0	0.0020	2170
R36	Resistor, fixed Film, 100Kg	RNC50H1003FM	100mW	2mW	0.05	0.0021	2170
,							

THE PERSONS

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TABLE 4-8B SERVO PRINTED WIRING BOARD RELIABILITY DATA

4	F.R. Source	2170	2170	2170	2170	2170	2170		2170		2170	2170	
Sheet 4 of	FAILURE RATE	0.0020	0.0020	0.0020	0.0020	0.0020	0.0021		0.0021		0.0935	0.0178	
S	STRESS RATIO	0.00	00.0	0.00	0.00	0.01		-					
	APPL 1ED STRESS	Omik	O ME	Omit	Omit	Jan 1	28°C	9	2,85				
REV.	RATED STRESS	100mW	100mW	100mW	100mW	100mW	ງ•\$01		105°C			•	
P/N C314300, REV.	PART NUMBER	RNC50HXXXXFM	RNC50H3011FM	RNC50H3011FM	RNC50H2002FM	RNC50H3011FM	M39010/3	-AA21KM	M39010/2	-AA21KM	SCD 316774	0314300	
30°C)	PART DESCRIPTION	Resistor, Fixed Film, 3.4Ku	Resistor, Fixed Film, 3.01Kg	Resistor, fixed Film, 3.01Ku	Resistor, Fixed Film, 20Kg	Resistor, Fixed Film, 3.01KG	Inductor, 220µH		Inductor, 220µH		Terminal (Qty. 17)	Printed Wiring Bd. (2-sided)	
(GF @ 30	REF	R37	R38	R39	R40	R41	=		12		El	Pw81	

TOTAL 0.769

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TABLE 4-8C

SERVO PRINTED WIRING BOARD RELIABILITY DATA

•	e ws)	40°C)	P/N C314300, REV.	٠٧.			Sheet 1 c	of 4
>60>7 · 8	REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPLIED STRESS	STRESS RAT10	FAILURE RAIE	r.R. SOURCE
1.618	5	IC, Linear, Op. Amp.	SCD 316786 (0P-14AZ/8838)	125°C	3°58		0.4987	2170
	ns	1C, Digital, Switch	J38510/05802BCC (CD4056BF)	150°C	ე。69		0.0254	2170
	u3	IC, Digital, Flip-Flop	MIL-M-38510 (CD4013AJ)	150°C	J.89		0.0285	2170
	U4	IC, Linear, Comparator	LM139/8838	150℃	J. 59		0.2220	2170
B-78	5	Transistor, SI, J FET	2N5116/JANTX	500mW 200°C	J°82	0.00	0.1040	2170
	0,7	Transistor, SI, NPN	M11-5-19500/255	400	308	0.75	0.0075	2170
			(2N2222A)	400mW 200°C	3mM 59°C	0.01		
	CR1	Diode, Sl. GP	M1L-S-19500/116	100v	84	0.08	0.0010	2170
			(JANTX1N4148-1)	200mW 175°C	0m₩ 58°C	0.00		
	(R)	Diode, SI, Zener, 7.5V	MIL-5-19500/127	400mW	7.5mW	0.19	0.0083	2170
			(JANTX1N755A-1)	175°C	81°C			
	5	Capacitor, Ceramic, 1se	M39014/2E-1407	200	10	0.02	0.0100	2170
	23	Capacitor, Ceramic, 33pf	M39014/1C-XXXX	1000	۸٥	0.00	te, 0t.3;	2170
	5	Capacitor, Ceramic, 33pf	M39014/1L-XXXX	1000	۸٥	0.00	e 903.2	217p
					1			

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TABLE 4-8C SERVO PRINTED WIRING BOARD RELIABILITY DATA

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୍ଟ ଅ ଅ.	40.00)	P/N C314300, REV	٧.			Sheet 2 o	of 4
REF	PART DESCRIPTION	FART NUMBER	RATED STRESS	APPLIED STRESS	STRESS RAT10	FAILURE	f.R. source
3	Capacitor, Ceramic, luf	M39014/2E-1407	500	00	0.00	0.0100	2170
53	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	15.V	0.15	0.0088	2170
90	Capacitor, Ceramic, luf	M39014/2E-1407	50v	44	0.08	0.0103	2170
(د/	Capacitor, Ceramic, luf	M39014/2E-1407	\$00	۸0	00.00	0.0101	2170
83	Capacitor, Ceramic, luf	M39014/2E-1407	\$0v	110	0.22	0.0141	2170
63	Capacitor, Ceramic, 0.01µf	CCR06CG103JM	200	84	0.16	0,0068	2170
010	Capacitor, Ceramic, 0.10µf	M39014/1C-1473	1000	15V	0.30	0.0156	2170
C11	Capacitor, Ceramic, 0.1 pf	M39014/1C-1473	1000	150	0.30	0.0156	2170
(12	Capacitor, Tantalum, 10µf	M39003/01-2304	35V	15V	0.43	0.1135	2170
C13	Capacitor, Ceramic, 0.1uf	M39014/1C-1473	100V	150	0.15	0.0088	2170
C14	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	88	0.08	0.0062	2170
615	Capacitor, Ceramic, 0.1µf	M39014/1C-1473	1000	110	0.11	0.0082	2170
910	Capacitor, Tantalum, 15uf	M39003/01-2304	35V	150	0.43	0.1191	2170
(1)	Capacitor, Tantalum, 15µf	M39003/01-2304	35V	15V	0.43	0.1191	2170
£ [#	Pesistor, Fixed Film, 10Kg	RNC50H1002FM	100mW	Mm()	00.00	0.0073	2170
.X	Resistor, Fixed Film, 10Kg	RNC50H1002FM	100mW	MmO	00.00	0.0073	2170
к3	Resistor, Fixed Film, 10Kg	RNC50H1002FM	100mW	OmW	00.0	0.0073	2170
ख अ	Resistor, Fixed Film, 20K.	RNC50H2002FM	100mW	Omk	00.00	0.0073	2170
Pr.S.	Resistor, Fixed Film, 499KL	RNC50H4993FM	100mW	Omw	00.0	0.0080	2170
98	Pesistor, Fixed Film, 499Kg	RNC50H4993FM	100mW	MuiC	00.00	0.0080	2170
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Fesistor, fixed film, 20kg	RNC50H2002FM	100mW	OmW	00.00	0,4673	2170
а. Э.	Pesistor, fixed Film, 10K.	RNU50H1002FM	100mW	MuiC	00.00	0,003	2170
64	Fesistor, fixed film, lows	PNC50H1002FM	100mM	, M(H)	00.00	670013	2170
		T	_	-		-	

SERVO PRINTED WIRING BOARD RELIABILITY DATA

P/N C314300, REV. (GM @ 40°C)

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						77 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	4-1
REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
R10	Resistor, fixed Film, 100Kg	RNC50H1003FM	100mW	МшО	0.00	0.0073	2170
	Resistor, Fixed Film, 100KG	RNC50H1003FM	100mW	MmO	00.00	0.0073	2170
R12	Resistor, Fixed Film, 10KQ	RNC50H1002FM	100шм	OmM	00.0	0.0073	2170
R13	Resistor, Fixed Film, 3.01KB	RNC50H3011FM	100mW	Omin	00.0	0.0073	2170
R14	Resistor, Fixed Film, 50KB	RNC50H5002FM	100шм	MmO	0.00	0.0073	2170
	Resistor, Fixed Film, 100KG	RNC50H1003FM	100mW	Omiv	0.00	0.0073	2170
R16	Resistor, Fixed Film, 24KB	RNC50HXXXXFM	100mW	Зшк	0.03	0.0074	2170
	Resistor, Fixed Film, 4.99K2	RNC50H4991FM	100mW	Omk	0.00	0.0073	2170
R18	Resistor, Fixed Film, 1.5K2	RNC55H1501FM	125mW	38mW	0.30	0.0103	2170
R19	Resistor, Fixed Film, 30.2	RNC50HXXXXFM	100mW	ЗтМ	0.03	0.0074	2170
R24	Resistor, Fixed Film, 100KG	RNC50H1003FM	100mW	MmI	0.01	0.0073	2170
R25	Resistor, fixed film, 49.9K2	RNC50H4991FM	100mW	OmM	0.00	0.0673	2170
R26	Resistor, Fixed Film, 698KA	RNC50H6983FM	100mW	OmM	0.00	0.000.0	2170
R27	Resistor, Fixed Film, 100KA	RNC50H1003FM	100mW	ImW	0.01	0.0073	2170
R28	Resistor, Fixed Film, 62KU	RNC50H6202FM	100ты	Mm0	0.00	0.0073	2170
R29	Resistor, Fixed Film, 3.01KG	RNC50H3011FM	100mW	37mW	0.37	0.0112	2170
R30	Resistor, Fixed Film, 3.01K2	RNC50H3011FM	100mW	3mW	0.03	0.0074	2170
R31	Resistor, fixed film, 10Kg	RNC50H1002FM	100mW	2 3mW	0.23	0.0095	2170
R32	Resistor, fixed film, 3.01Kg	RNCSOH3011FM	100m	OmW	00.0	0.0073	2170
R33	Resistor, Fixed Film, 3.01K2	RNC50H3011FM	100mW	OmM	0.00	0.0073	2170
R34	Resistor, fixed film, 11.352	RNC50H1132FM	100mW	1 1mk	0.11	0.0073	2170
R35	Resistor, fixed film, 10Kg.	RNCSOH1002FM	100mW	Mm/O	0.00	0.0073	2170
R 16	Resistor, fixed film, 100kg	RNC50H1003FM	100mW	2mM	0.05	0.0073	2170

TABLE 4-8C

andicate accepted proposed present provides

SERVO PRINTED WIRING BOARD RELIABILITY DATA

ſ	1												 	 		 	
4 J	F.R. SOURCE	2170	2170	2170	2170	2170	2170	0,110	0/17		2170	2170					 ا : ! أــــــــــــــــــــــــــــــــــ
Sheet 4 of	FAJLURE RATE	0.0073	0.0073	0.0073	0.0073	0.0073	0.0086	0 0086	0.000	6	0.3230	0.0597					
	STRESS RATIO	00.00	0.00	00.0	0.00	0.01											; ;
	APPL 1ED STPLSS	OmW	Ŋwo	OmM	Omik	ME	ວ89	J. 07	ر ٥٥								,
REV.	RATED STRESS	100mW	100mW	100mW	100mW	100mW	105°C		105°C								
P/N C314300, R	FART NUMBER	RNCSOHXXXXFM	RNC50H3011FM	RNC50H3011FM	RNC50H2002FM	RNC50H3011FM	M39010/3	-AA21KM	M39010/2	-AA21KM	SCD 316774	0314300			•		
() _* ()	PART DESCRIPTION	Resistor, Fixed Film, 3.4Ku	Resistor, Fixed Film, 3.01Ku	Resistor, fixed film, 3.01Ku	Resistor, Fixed Film, 20K2	Resistor, Fixed Film, 3.01KG	Inductor, 220µH	:	Inductor, 220µH		Terminal (Qty. 17)	Printed Wiring Bd. (2-sided)					
(CM # 40°C)	REF SYMBOL	R37	K38	R39	R40	R41 .	=		77		- I	PW81		 •			
,	76077	1678											 			 	 _

ASSISTANCE PRODUCTION ASSESSED. RECECCES

TOTAL

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TABLE 4-9A

THERMOELECTRIC CONTROLLER RELIABILITY DATA

(AUF @	2°C)	P/N C314296,	REV.			Sheet 1 c	of 2
REF SYMBOL	FART DESCRIPTION	PART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
	IC, Linear, Switch, Voltage Regulator	UA78540DM (883B)	125°C	24°C		0.3883	2170
	Diode, Zener, 33V	1N5257/JANTX	500mW 200°C	От. 20°С	0.00	0.0284	2170
	D10DE, S1, Zener, Power, 33V	MIL-S-19500/434 (JANTXIN5610)	1.5KW 200°C	0KW 20°C	0.00	0.0189	2170
	Diode, SI, Rectifier	MIL-S-19500/286 (JANTX1N4942)	200V 500mW 175°C	0V 0mW 20°C	0.00	0.0019	2170
	Diode, SI, Rectifier	MIL-S-19500/286 (JANTX1N4942)	200V 500mW 175°C	0V 0mW 20°C	0.00	0.0019	2170
	Capacitor, Ceramic, 0.01µf Capacitor, Ceramic, 0.1µf	M39014/1C-1455 M39014/1C-1473	100V 100V	5V 23V	0.05	0.0107	2170 2170
	Capacitor, Tantalum, 6.8µf Capacitor, Ceramic, 27pf	M39003/02-0180 CCR05CG220JM	50V 100V	25V 1V	0.50	0.3946 0.0037	2170
	Capacitor, Ceramic, 0.01µf Capacitor, Tantalum, 5µf	M39014/1C-1455 M39006/03-1379	100V 200V	28V 0V	0.28	0.0192	2170
	Capacitor, Ceramic, luf Resistor, fixed film, 20Kg	M39014/2E-1407 RNC50HXXXXFM	100V 100mW	OV 2mW	0.00	0.0176	2170 2170
,				:			

TABLE 4-9A

THERMOELECTRIC CONTROLLER RELIABILITY DATA

	(AUF @	2°C)	P/N C314296,	REV.			Sheet 2 of	£ 2
+60+V · 8	REF SYMBOL	FART DESCRIPTION	PART NUMBER	RATED STRESS	APPL IED STRESS	STRESS RATIO	FATLURE RATE	r .R. Source
1678	R2	Resistor, Fixed Film, 90.9Ku	RNC50HXXXXFM	100m₩	1mW	0.01	0.0133	2170
	R 3	Resistor, Fixed Film, 1KO	RNC50H1001FM	100mW	10mk	0.10	0.0146	2170
	R4	Resistor, Fixed Film, 68.1KG	RNC50HXXXXFM	100mW	2mM	0.05	0.0134	2170
	RS	Resistor, Fixed Film, 49.9Kn	RNCSOHXXXXFM	100mW	MWO	0.00	0.0133	2170
	R6	Resistor, Fixed Film, 49.9KA	RNC50HXXXXFM	100mW	I I	0.01	0.0133	2170
	R7	Resistor, Fixed Film, 10KD	RNC50H1002FM	100mW	₩ш29	0.65	0.0264	2170
	R8	Resistor, Fixed Film, 1KQ	RNC50H1001FM	100mW	Min.	0.01	0.0133	2170
	6X	Resistor, Fixed Film, 1KD	RNC50H1001FM	100mW	OmM	0.00	0.0133	2170
	R10	Resistor, Fixed Film, 10KB	RNC50H1002FM	100m	A MINO	0.00	0.0133	2170
B-8	<u>-</u>	Transformer, Power	8316747	105°C	20°C		0.0292	2170
33	21	Transformer	8314327	105°C	ე₀0Շ		0.1555	2170
	5	Terminal (Qty. 17)	140-1385-02				0.4199	2170
	PW81	Printed Wiring Bd (2-sided)	180				0.1220	2170
								
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TOTAL

TABLE 4-9B

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THERMOELECTRIC CONTROLLER RELIABILITY DATA

	(GF a 3	30°C)	P/N C314296,	REV.			Sheet 1 o	of 2
+60+4 - (REF SYMBOL	PART DESCRIPTION	PART NUMBER	RATED STRESS	APPL 1ED STRESS	STRESS RATIO	FAILURE RATE	F.R. Source
1676	U)	IC, Linear, Switch, Voltage Regulator	UA78S40DM (883B)	125°C	52°C		0.2148	2170
	CRI	Diode, Zener, 33V	1N5257/JANTX	500mW 200°C	OmW 48°C	0.00	0.0020	2170
·····	CR2	D10DE, SI, Zener, Power, 33V	MIL-S-19500/434 (JANTX1N5610)	1.5KW 200°C	0KW 48°C	0.00	0.0013	2170
	CR3	Diode, SI, Rectifier	MIL-S-19500/286 (JANTX1N4942)	200V 500mW 175°C	OmW 48°C	0.00	0.0003	2170
	CR4	Diode, SI, Rectifier	MIL-S-19500/286 (JANTXIN4942)	200V 500mW 175°C	0V ОмW 48°С	0.00	0.0003	2170
	CI	Capacitor, Ceramic, 0.01µf	M39014/1C-1455	1000	5V	0.05	0.0012	2170
	23	Capacitor, Ceramic, 0.1µf Capacitor, Tantalum, 6.8µf	M39014/1C-1473 M39003/02-0180	100V 50V	23V 25V	0.23	0.0023	2170 2170
	6.4	Capacitor, Ceramic, 22pf	CCR05CG220JM	1000	7 :0	0.01	0.0005	2170
	S 3	Capacitor, Ceramic, 0.01µf Capacitor, Jantalum, 5µf	M39014/1C-1455 M39006/03-1379	100V 200V	787 00	0.28	0.0022	2170 2170
	(7	Capacitor, Ceramic, luf	M39014/2E-1407	1001	00	0.00	0.0020	2170
	8	Resistor, Fixed Film, 20KD	RNC50HXXXXFM	100mW	2mW	0.05	0.0021	2170
_	1							

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TABLE 4-9B

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THERMOELECTRIC CONTROLLER RELIABILITY DATA

	TI														 _
of 2	F.R. SOURCE	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	
Sheet 2 o	FAILURE RATE	0.0020	0.0023	0.0021	0.0020	0.0020	0.0043	0.0020	0.0020	0.0020	0.0203	0.1081	0.0935	0800.0	
	STRESS RATIO	0.01	0.10	0.05	0.00	0.01	0.65	0.01	0.00	0.00					
0100	APPL 1ED STRESS	JmW	10mk	2mk	AEO	J.	65mW	JE C	O MILE	Jame O	7°8₽	4 8°C			
REV.	RATED STRESS	100mW	100mW	100mW	100mW	100mW	100mW	100mW	100mW	100mW	105℃	ງ°201			
P/N C314296, REV.	PART NUMBER	RNC50HXXXXFM	RNC50H1001FM	RNC50HXXXXFM	RNC50HXXXXFM	RNCSOHXXXXFM	RNC50H1002FM	RNC50H1001FM	RNC50H1001FM	RNC50H1002FM	8316747	8314327	140-1385-02	T80	
	PART DESCRIPTION	Resistor, Fixed Film, 90.9KD	Resistor, fixed Film, 1KQ	Resistor, Fixed Film, 68.1KQ	Resistor, Fixed Film, 49.9KD	Resistor, Fixed Film, 49.9KG	Resistor, Fixed Film, 10KG	Resistor, Fixed Film, 1KD	Resistor, Fixed Film, 1KO	Resistor, Fixed Film, 10KΩ	Transformer, Power	Transformer	Terminal (Qty. 17)	Printed Wiring Bd (2-sided)	
(GF & 30°C)	RE F SYMBOL	R2	R3	R4	R5	R6	R7	88	R9	R10	=	12	E1	PWB1	

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TABLE 4-9C
THERMOELECTRIC CONTROLLER RELIABILITY DATA

TABLE 4-9C

THERMOELECTRIC CONTROLLER RELIABILITY DATA

٢															
2 J	r .R. Source	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	
Sheet 2 of	FA11 URE RATE	0.0073	0.0081	0.00/3	0.00/3	0.0073	0.0158	0.0073	0.0073	0.0073	0.0494	0.2637	0.3230	0.0268	
	STRESS RATTO	0.01	0.10	0.05	00.00	0.01	0.65	0.01	0.00	0.00					
<u> </u>	APPL 1ED STRESS	Tel.	10mM	2mW	Omik	JmM	65mW	18E	OmM	A THE	J,85	ე _ა 8 5		-	
REV.	RATED STRESS	100mW	100mW	100mW	100mW	100mW	100mk	100mM	100mM	100mW	105°C	105°C			
P/N C314296,	PART NUMBER	RNCSOHXXXXFM	RNC50H1001FM	RNCSOHXXXXFM	RNC50HXXXXFM	RNCSOHXXXXFM	RNC50H1002FM	RNC50H1001FM	RNC50H1001FM	RNC50H1002FM	8316747	8314327	140-1385-02	180	
4(°C)	FART DESCRIPTION	Resistor, fixed Film, 90.9Ka	Resistor, Fixed Film, 1KU	Resistor, Fixed Film, 68.1KD	_	Resistor, Fixed Film, 49.9KG	Resistor, Fixed Film, 10KB	Resistor, fixed Film, 162	Resistor, Fixed Film, 1Ka	Resistor, Fixed Film, 10K2	Transformer, Power	Iransformer	Terminal (Qty. 17)	Printed Wiring Bd (2-sided)	
)+ ~ N())	REF SYMESOL	23	23	RA	R5	R6	R7	88	R9	R10	=	12	E	PW81	

TOTAL

1.363

THE SECRETARY OF SECOND SECOND PROPERTY SECONDS

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TABLE 4-10A
PHYSICS PACFAGE AND MISCELLANGOUS PART RELIABILITY DATA

•	(AUF 3	2°C)					Sheet 1 c	of 1
O ·	PEF SYMBOL	PART DESCRIPTION	FART NUMBER	RATED STRESS	APPL TED STRESS	STRESS RATIO	FAILURE RATE	F.R. SOURCE
16 18	l dd	Physics Package Cells					0.6850	Note 1
	104	Phutodetector		150°C	J°27		0.1110	2170
	Ŧ	Heater, Lamp Oven					0.0950	Note 2
	H 2	Heater, Cavity Oven					0.0190	Note 2
	THI	Thermistor, Bead Type					1.2390	2170
	TH2	Thermistor, Bead Type					1.2390	2170
		Coil, C-Field					0.4980	2170
	16	Thermoelectric Modules (4)					0.000	Note 3
R_89								
•		•				101AL	3.886	

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TABLE 4-10B
PHYSICS PACKAGE AND MISCELLANEOUS PART RELIABILITY DATA

,	(GF & 30°C)	30°C)					Sheet 1	of 1
*60**	REF SYMSOL	PART DESCRIPTION	FART NUMBER	RATED STPESS	APPLIED STRESS	STRESS RATIO	FAILURE	F.R. SOURCE
16.0	pp]	Physics Package Cells					0.6850	Note 1
	PD1	Photodetector		150°C	J.81		0.0320	2170
	Ξ	Heater, Lamp Oven					0.0950	Note 2
	2н	Heater, Cabity Oven					0.0190	Note 2
	THI	Thermistor, Bead Type					0.1008	2170
	TH2	Thermistor, Bead Type					0.1008	2170
		Coll, C-Field			-		0.0640	2170
	TE	Thermoelectric Modules (4)					0.000.0	Note 3
								
_		L L	T	7				

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TOTAL

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TABLE 4-10C
PHYSICS PACFAGE AND MISCELLANEOUS PART RELIABILITY DATA

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	1		ļ
of 1	r.k. Source	Note 1 2170 Note 2 2170 2170 2170 Note 3	-
Sheet 1	FAILURE RATE	0.6850 0.1030 0.0950 0.0190 0.5250 0.5250 0.2130	
	STRESS RATIO		1
	APPLIED STRESS	75°C	1
	RATED STRESS		
40°C)	PAPT AUMBER		
	PAET DESCRIPTION	ype ype	T
(63 6 40	REF	PP1 PD1 H1 TH2 L1 TE	1

2.165

TOTAL

APPENDIX C

ESSENT LEASTERS ISSUED TO THE TOTAL PROPERTY.

TRFS QUALIFICATION TEST PLAN

Qualification Test Plan Tactical Rubidium Frequency Standard (TRFS)

ELECTRONIC SYSTEMS DIVISION HANSCOM AFB, MASSACHUSETTS 01731

DATE: 10 March 1986

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5.0	PHYSICAL INSPECTION/REQUIREMENTS	(i = .
6.0	PERFORMANCE TESTS	C-7
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8.9	Humidity	(-)-
8.10	Fungus	6-3-
8.11	Explosive Atmosphere	C− 14 C−35
8.12	Rain	('= 5'
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9.1	Test Conditions	Ç=4 ·
9.2	Test Procedure	(1
9.3	Pass/Fail Criteria	(= 4 l
10.0	FINAL PERFORMANCE TESTS	(!
10.1	Long-Term Stability	

- 1.0 SCOPE

 1.1 This document describes the qualification seate to be preferred that because any advanced requescy diseased (1979). The purpose of these twents is to ensure that the TMF weets the requirements of the Tactical Aubidius Preguency Standard Specifications.

 2.0 APPLICABLE DOCUMENT The following document for the extent specified herein. In the west of conflict between the documents creared herein and the contents of this specification, the contents of this specification, the contents of this specification and Standards

 2.1 Military Specifications and Standards

 Mil-C-13012 C Connector, Clectrical, Circular, Miniature.

 Mil-C-13012 C Connector, Coaxial, Radio Fragmency.

 Mil-STD-850C Environmental Test Method

 Mil-STD-850C Environmental Test Method

 Mil-STD-850C Calibration System sequirement

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 14 Dec 1984

 Mil-STD-862

 31 July 1967

 Mil-STD-862

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 Mil-STD-863

 Notice 4, 1 Appli 1968

 Notice 7, 1 may 1970

 Mil-STD-80 R Silectromagnatic Interference Characteristics, Measurement of.

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 Notice 7, 1 may 1970

 Mil-STD-80 R Silectromagnatic Enterference Characteristics, Measurement of.

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3.0 GENERAL REQUIREMENTS

- a. Unless otherwise specified all tests are to be conducted under the standard operating conditions specified in Table 3-1.
- b. All test data and pertinent information shall be recorded on Qualification Test Data Sheets. All Test Data Sheets will be signed and dated by the person conducting the test.
- c. Whenever possible, electrical tests are to be made through connector savers, whose purpose is to minimize wear on the unit connectors.
- d. The TRFS final assembly will have completed all inprocess manufacturing procedures, inspections, environmental stress screening, and Acceptance Test Procedures (ATP), prior to formal qualification testing.
- e. All testing shall be conducted using test equipment and measuring instruments whose accuracy and/or calibration has been verified in accordance with MIL-STD-45662 and whose resolution is adequate for the required measurement.
- f. Notification of testing shall be made to RADC 3 days prior to the start of each test. Failure notification to RADC within 24 hours of failure. Failure analysis shall be performed for each failure, and provide to RADC within 5 days. A qualification test log book shall be maintained throughout testing.

4.0 QUALIFICATION TEST SEQUENCE

The required Qualification Tests may be performed on one or two TRFS units. The sequence of environmental testing is optional, with the exceptions; that the Rain test must follow both Vibration tests and EMI testing must follow Environmental Testing.

Unit A

Physical Inspection
Performance Tests
Functional Tests
Environmental Tests
Temperature/Altitude
Temperature/Shock
Random Vibration
Sinusoidal Vibration
Rain
Bench Handling Shock
Operational Shock
Acceleration
Acoustic Noise
EMI Tests
Final Performance Tests

Unit B

Physical Inspection
Performance Tests
Functional Tests
Environmental Tests
Humidity
Fungus (by analysis)
Explosive/Atmosphere
Salt/Fog
Sand & Dust
Final Performance Tests

TABLE 3-1

STANDARD OPERATING CONDITIONS

PARAMETER	CONDITION
Hounting	TRFS Baseplate attached to a suitable heat sink.
Ambient Air Temperature	+25°C <u>+</u> 5°C
Input Supply Voltage (Heater and Electronic)	+25.0 +0.5 Vdc without ripple, transients or other perturbations.
Shock, Vibration & Noise	None deliberately applied.
Barometric Pressure	Normal room ambient.
Humidity	Normal room ambient.
Load Impedance on 10 MHz RF output	50 ohms <u>+</u> 5%
frequency Adjustment	The TRFS frequency shall be adjusted to 10 MHz +5pp 10 ¹¹ nominal using its C-field Frequency adjustment.

5.0 PHYSICAL INSPECTION/REQUIREMENTS

Weight (3.2.2.2).

- a. Weigh the unit under test.
- b. The weight of the TRFS shall not exceed 3.0 pounds. Indicate compliance on Test Data Sheet.

Dimensions (3.2.2.1).

The TRPS shall not exceed the following dimensional parameters: size(inches) 3.25 H X 3.25W X 4.5L; k factor total length 0.97 inches (0.72° front and 0.25° rear). Indicate compliance on Test Data Sheets.

Plating and Sealing (3.3.1.10).

The unit shall be free of nicks, flaking and rust. Surface flatness of the FSU baseplates shall be 0.005 inches TIR or better. Surface finish shall be 32 microinches RMS or better. Indicate compliance on Test Data Sheets.

Connectors (3.2.2.3).

Connector pins shall be straight and free of solder or corrosion. Connectors shall be per MIL-C-38999 series I, shell size 11, insert arrangement 35. Coaxial connector type "TNC" shall be IAW MIL-C-39012.

Other Requirements (3.2.2.4)

Manufacturing marking shall be affixed to the exterior front panel of the TRFS.

Frequency adjustment control shall be accessable from the back of the TRFS.

Mounting holes shall be per Figure 2 of Hazeltine 332819. Indicate compliance on Test Data Sheets.

6.0 PERFORMANCE TESTS

The purpose of the performance tests is to verify that the TRFS meets all the electrical performance requirements as specified in Hazeltine Document 332819.

performance testing shall be performed prior to applications of any of the environmental tests specified in Paragraph 8 to the TRFS. Data obtained from these tests shall provide the criteria by which all further performance testing shall be judged.

After completion of all environmental and EMI testing, the TRFS shall be subjected to a final electrical performance test. This final test shall be a repeat of performance testing.

6.1 Harmonic/Nonharmonic Distortion (3.2.1.8).

Harmonics.

- A. Connect the TRPS as shown in Pigure 6-1, using a direct connection spectrum analyzer. Apply input voltage and allow 1 hour warmup.
- B. Observe all harmonics on the spectrum analyzer. Harmonic distortion shall be down greater than 30 dB from the carrier.
- C. Record all out of spec readings on the test data sheet.

Nonharmonic/Spurious.

- A. Connect the TRFS as shown in Figure 6-1, using a 10 MHZ reject filter, if required, in series with the spectrum analyzer. Apply input voltage and allow 1 hour warmup.
- B. Observe all spurious and nonharmonic outputs on the spectrum analyzer. These outputs shall be down by 60 dB or greater.
- C. Record all out of spec readings on the test data sheet.

6.2 Frequency Stability Vs. Input Voltage (3.2.1.6).

- A. Connect the TRFS to an appropriate test setup. Apply input voltage and allow 1 hour warmup.
- B. Sequentially set the input voltage to the following values while observing the chart recording of the frequency shift (Δ f/f) at each input voltage setting.

Input Voltage Setting

Electronics Input	Heater Input	
22 Vdc	22 Vdc	
26 Vdc	20 Vdc	
23.4 Vdc	28 Våc	
28.6 Vdc	28 Vác	
32 Vdc	29 Vdc	

- C. The frequency shift for electronic input voltage setting from 23.4 Vdc to 28.6 Vdc shall be less than 1 pp 10¹¹, for electronic input voltage of 22 Vdc and 32 Vdc frequency shift shall be less than 5 pp 10¹¹. Record readings on test data sheet.
- D. With the input voltages set to 26 Vdc, drop the heater input voltage to 0 Vdc for 10 seconds. Observe and record the frequency prior to the voltage dropout and after 10 seconds of voltage dropout. The frequency variation shall be less than 1 x $_{10}^{-8}$.

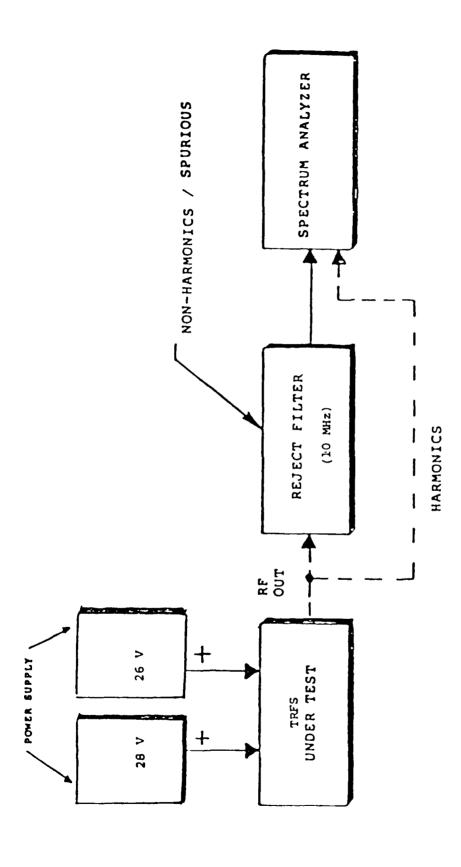


Figure 6-1 HARMONIC AND SPURIOUS TEST SETUP

Frequency Adjustability (3.2.1.3).

- 6.3 Frequency Adjustabili

 A. Connect the TR

 voltage and al Connect the TRFS to an appropriate test setup. Apply input voltage and allow 1 hour warmup.
 - В. Vary the mechanical frequency adjust, observe and record the output frequency. Insure that the output frequency is capable of being adjusted over the range of 3 pp 109. Record the minimum and maximum limits of adjustment on the test data sheet.
 - Insure that the output frequency is capable of being set to a C. resolution of 2 pp 1011. Record data on test data sheet.
 - n. Reset the output frequency to 10 MHz and record the frequency value.

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Frequency Stability Vs. Orientation (3.2.2.5).

- Connect the TRFS to an appropriate test setup. Apply input voltage and allow 1 hour warmup.
- Measure the output frequency (F_0) while the TRFS is mounted in its normal orientation. Record on data sheet.
- Sequentially place the TRFS in the . 5 remaining orientations c. (left side down, top side down, right side down, back side down, front side down).
- Observe and record the frequency shift ($\mathcal{L}f/f$) at each n. position after 5 minutes stabilization time and record on data sheet.
- The frequency shift at each position shall not be greater than 5 parts in 1011 relative to the output frequency (Fo) reading recorded in step B.

Frequency Stability Vs. DC Magnetic Field (3.2.1.9). 6.5

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- Setup a uniform magnetic field of 2 Gauss DC minimum. λ.
- Connect the TRFS to an appropriate test setup. Apply input В. voltage and allow 1 hour warmup.
- Mount the TRFS within the field with its X-axis in the c. direction of the field. Observe & record the frequency on the chart recorder.
- Reverse the magnetic field and observe the frequency change D. $(\Delta f/f)$.
- Repeat parts C and D with the Y-axis and Z-axis in the Ε. magnetic field direction.
- The frequency shift at each reversal of magnetic field exposure shall not be greater than 2 pp 1011/Gauss. Record data for each case.

6.6 Frequency Retrace (3.2.1.5)

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A. Connect the TRFS to an appropriate test setup. Apply input voltage and allow 1 hour warmup.

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- B. Measure the output frequency (F_O) of the TRFS and record on test data sheet.
- C. Remove all power from the TRFS for at least eight hours.
- D. At the end of step C, apply power to the TRFS. Allow one hour for warmup and remeasure the output frequency. Record reading on test data sheet.
- E. Repeat steps C and D two additional times.
- F. The total retrace error shall be less than 5 pp 10¹¹ from the initial measurement.

6.7 Built-In-Test (BIT) (3.2.1.16)

- A. Connect the TRPS to an appropriate test setup.
- B. With the TRFS in an unpowered state connect pin 1 of connector J2 through a current limiting 1.5 Kohm resistor to a 30 Vdc power source. With the unit deenergized the leakage current shall be less than 100 microamps.
- C. Energize the unit and allow 1.5 minutes warmup, the voltage drop to ground from Pin 1 shall not exceed 1 volt to indicate a "go" condition.

6.8 Crystal Control Voltage Test (3.2.1.17)

- A. Connect the TRFS to an appropriate test setup.
- B. Connect a digital voltmeter across pin 2 on connector J2 and ground.
- C. Measure the output voltage indicated at pin 2 and record on test data sheet.
- D. The voltage indicated shall be 7.5 +/-2VDC.

6.9 Short Circuit Protection (3.2.1.15)

- A. Connect the TRFS to an appropriate test setup.
- B. Measure and record the 10 MHz output frequency and amplitude at J1 output port, using an RF voltmeter. Output amplitude shall be 0.5 Vrms. Required limits: 0.650 Vrms max., 0.450 Vrms min. Frequency shall be 10 MHz +5 pp 10¹¹.
- C. Short circuit the output at J1 to ground.
- D. Remove the ground and repeat step (B). Record reading on test data sheet.

- E. With the TRFS energized, sequentially ground each output pin of the J2 connector for at least 30 seconds.
- F. Measure frequency and voltage output at the J1 connector. Frequency variation shall be less than 5 pp 10¹¹.

6.10 Short Term Stability (3.2.1.5 of Solid State Sciences Division, Specifications for TRFS)

The short-term stability test setup is to determine the Allan Variance.

A minimum of 3 1/2 hours of data (at least 100 samples for each averaging time) shall be collected for the Allan Variance computation. A plotted graph will be attached to the data sheets.

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Averaging Time	Required
1.0 second	4 x 10 ⁻¹¹
10.0 seconds	1.265 X 10-11
100.0 seconds	4 x 10-12

6.11 Output Impedance (3.2.1.1)

- A. Connect the TRFS to an appropriate test setup.
- B. Apply input power to the TRFS. Measure and record output impedance at the J1 connector.

6.12 Warmup and Power Consumption (3.2.1.10), (3.2.1.11), (3.2.1.12)

- A. Connect the TRFS to an appropriate test setup. Turn off unit power for a minimum of 30 minutes.
- B. Apply input voltages to the TRFS and immediately measure and record the peak input currents, input voltages (both the 28V and 26V) and output frequency. Calculate input power from the input current and voltage readings (P = £I).
- C. Requirements are as follows:

Input Power	Requirement	
Peak during warm-up for heaters and electronics	<pre><110 watts (for 2 minutes maximum)</pre>	
Steady State Maximum solid state heater and electronics	<17 watts	

Output Prequency

Within

Required Accuracy

WINDSTEEL TRANSPORTER TO SECOND TRANSPORTER TRANSPORTER

2 minutes

 1×10^{-9}

2.5 minutes

5 x 10-10

D. Heasure and record the time to lock-on. Time to lock-on is < 90 seconds at ambient temperature (25°C). Increase the time to lock by 1sec/°C for lower temperatures.

6.13 Signal to Noise Test (3.2.1.7)

- A. Connect the TRPS to an appropriate test setup.
- B. Measure the phase noise at 1Hz from the carrier. Record reading on the test data sheet.
- C. Measure the phase noise at 100 Hz from the carrier. Record reading on the test sheet.
- D. Measure the phase noise at 1k Hz from the carrier. Record reading on the test data sheet. Attach plot of the output phase noise to test data sheet.
- E. The phase noise limits are specified below:

Offset From 10M	ignal/Noise Ra BC Hz	atio-Required
1 Hz	 > 60) dB
100 Hz	> 80) dB
1K Hz	> 95	5 dB

7.0 PUNCTIONAL TEST

The purpose of the functional test is to verify that the TRFS is operating normally before and after exposure to each of the environmental tests described in this document.

A functional test conducted after the completion of one environmental exposure may be used as the pretest for the next environmental exposure.

7.1 Output Level and Prequency (3.2.1.1) (3.2.1.2)

- A. After stabilization measure and record the output frequency and amplitude.
- B. The output frequency shall be 10 MHz and the fractional frequency offset be no greater than 5 \times 10⁻¹¹.
- C. The output amplitude, as measured with the RF voltmeter shall be 0.5 Vrms into a 50 ohm load. Required limits: 0.650 Vrms max., 0.450 Vrms min.

- D. Total input power should not exceed 17 watts.
- E. Measure VCXO control voltage. Acceptable voltage range shall be 3-12 Vdc.

8.0 ENVIRONMENTAL TESTS

Output voltage throughout all environmental tests shall remain between .45Vrms and .65Vrms.

8.1 Temperature/Altitude Test (3.2.1.13), (3.2.1.14), (3.2.5.1.5), (3.2.5.1.1), (3.2.5.1.3)

Pre-Temperature Altitude Functional Test

Prior to commencing the temperature altitude environmental test, the TRFS shall be subjected to the test detailed in paragraph 7.0

Test Procedures

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Perform test in accordance with MIL-STD-810 Test Method 504.1, Procedure 1.

- A. Install the the TRFS on heatsink, install the unit in the test chamber in a way that allows circulating air to flow over the heatsink only. Route all functional cables from the test unit to the test console, and all thermocouple leads from the chamber via the chamber port. Connect all required cables and leads and seal port.
- B. Attach thermocouples at following locations to monitor temperature stabilization periods during test: Thermocouple No. 1 at test unit base plate, Thermocouple No. 2 at chamber air.

Temperature stabilization will have been attained when the temperature of the baseplate does not change more than 2°C per hour.

Thermocouple reading intervals shall be 15 minutes during the power on periods of this step and one hour during stabilization periods.

- C. With the test unit deenergized, adjust the chamber temperature to -62°C and allow the unit to stabilize. Maintain this condition for a period of two hours minimum. The thermocouple reading interval shall be 30 minutes during this step. During the test, observe the test unit through the chamber window to determine, to the extent possible, any damage or deterioration.
- D. With the test unit deenergized, adjust the chamber temperature to -54°C and allow the unit to stabilize. After stabilization and with the chamber maintained at -54°C, energize the test unit using an input voltage of 22+/-.1Vdc. perform an output frequency check and ensure that the time

necessary to achieve frequency offset of less than 5 x 10^{-10} is less than four minutes. Measure peak input power and output amplitude of the 10MHz signal and VXCO voltage.

Input Power

Requirement

Peak during warm-up for heaters and electronics

<110 watts (for 2 minutes maximum)</pre>

Steady State Maximum solid state heater and electronics

<23 watts

Output Frequency

Within

Required Accuracy

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2 minutes

1 x 10-9

4 minutes

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5 x 10-10

Record data on test data sheet. Frequency offset after one hour shall be less than 3 x 10^{-10} . Deenergize the test unit and restabilize it at -54°C . This operational sequence shall be repeated two additional times. Subsequent frequency reading for the last two cycles shall deviate less than 5 x 10^{-11} from the first reading.

- With the test unit deenergized, adjust chamber temperature to -54°C and allow the unit to stabilize. After stabilization, energize the test unit using the input voltage of 32+/-.1Vdc allow 1/2 hour warmup time, measure and record output frequency and voltage. Adjust the chamber pressure to simulate an altitude of 70,000 feet.
- F. Upon reaching the specified chamber pressure (70,000 feet) and while maintaining the chamber temperature, measure and record the test unit output frequency and voltage. Frequency variation shall be less than 1 x 10⁻¹³/mbar (1 pp 10¹⁰). Adjust chamber pressure to ambient condition. Thermocouple reading intervals shall be every 15 minutes during the power on period of this test and 30 minutes during stabilization periods.
- G. With the test unit deenergized, adjust the chamber temperature to -10°C and allow the unit to stabilize. Open the chamber door and allow frost to form on the test unit. If no frost forms, artificially increase the chamber humidity until it does. Leave the door open until the frost melts then close the door before the moisture evaporates.

After closing the chamber door, energize the test unit using an input voltage of 32+/-.lVdc. Allow the TRFS to operate for a period of five minutes then turn off power for five minutes. Repeat the five minute on/off procedure two additional times to confirm that no malfunction was caused by formation of the moisture. Thermocouple reading intervals shall be 15 minutes from the time the chamber door is first open until this test step is completed. Perform a Functional Test as specified in paragraph 7.0.

- H. With power to the test unit off, allow the test chamber to return to standard ambient conditions. Allow the test unit to stabilize for one hour. Perform test specified in paragraph 7.0.
- I. With the test unit deenergized adjust the chamber temperature to +95°C and allow the unit to stabilize. Maintain this condition for a period of 16 hours minimum. The thermocouple reading interval shall be 30 minutes during this step. During the test, observe the test unit through the chamber window to determine, to the extent possible, any damage or deterioration.
- J. With the test unit deenergized, adjust the chamber temperature to 71°C and allow the unit to stabilize. With the chamber temperature maintained at 71°C, energize the TRFS using an input voltage of 32 Vdc and maintain for a period of four hours. Monitor baseplate temperature and raise chamber temperature to ensure that baseplate temperature equals 71°C plus .45°C per watt of power consumption. At no time shall chamber temperature fall below 71°C. Thermocouple reading intervals shall be every 30 minutes during this step. At the end of the four hour period, measure and record output frequency. Frequency offset shall be less than 3 x 10°10.

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- K. With the test unit deenergized, adjust the chamber temperature to 36°C and allow the test unit to stabilize. After stabilization, energize the unit using an input voltage of 32Vdc and allow to stabilize. With the unit operating, reduce the chamber pressure to simulate an altitude of 50,000 feet. Maintain these conditions for a period of four hours. At the end of the four hour period measure and record output frequency and voltage. Frequency variation shall be less than 1 x $10^{-13}/\text{mbar}$ (8.5 x 10^{-11}). Then increase chamber pressure to the ambient level. Thermocouple reading intervals shall be 30 minutes during the power on period of this test step and one hour during the stabilization period.
- L. With the TRFS deenergized, adjust the chamber temperature to 60°C and allow the test unit to stabilize. After stabilization energize the unit using an input voltage of 32 Vdc. With the unit operating, reduce the chamber pressure to simulate an altitude of 50,000 feet and maintain for a total energized time of 30 minutes, then turn off for 15 minutes.

Repeat the 30 minute on/15 minute off sequence three additional times. thermocouple reading intervals shall be 15 minutes during this test step. Printouts shall be set to occur at power on, mid sequence, and power off. During each operating time period, measure and record output frequency. Frequency offset shall be less than 1 x 10^{-13} /mbar (8.5 x 10^{-11}).

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- M. With the TRFS deenergized, adjust the chamber temperature to 10°C and allow the test unit to stabilize. After stabilization, energize the unit using an input voltage of 32Vdc. With the unit operating, reduce the chamber pressure to simulate an altitude of 70,000 feet. Maintain these conditions for a period of four hours. At the end of the four hour period measure and record output frequency and voltage. Frequency variation shall be less than 1 x 10⁻¹³/m bar (1 x 10⁻¹⁰). Increase chamber pressure to ambient level. Thermocouple reading intervals shall be 15 minutes during the power on period of this test and 30 minutes during the stabilization period.
- With the TRFS deenergized, adjust the chamber temperature to 35°C and allow the test unit to stabilize. After stabilization, energize the unit using an input voltage of 32 Vdc. With the unit operating, reduce the chamber pressure to simulate an altitude of 70,000 feet and maintain in this mode for a total energized time of 30 minutes, then turn off for 15 minutes. Repeat the 30 minute on, 15 minute off sequence three additional times, then increase the chamber pressure to the ambient level. Thermocouple reading intervals shall be every 10 minutes during this test step.

Printout: shall be set to occur at power on, mid sequence, and power off.

During each operating time period measure and record the frequency output and voltage. Frequency offset shall be less than 1 \times 10⁻¹³/m bar (1 \times 10⁻¹⁰).

O. Adjust chamber test conditions to standard ambient. After the test unit has stabilized, visually inspect the unit for signs of damage and perform the tests detailed in paragraph 7.0.

8.2 Temperature/Shock Test (3.2.5.1.3), (3.2.1.13), (3.2.5.1.4)

Pretemperature/Shock Functional Test

Prior to commencing the temperature shock test, the TRFS shall be subjected to the test detailed in paragraph 7.0.

Test Procedure.

Perform test in accordance with MIL-STD-810, Test Method 503.1, Procedure 1.

- A. Place the TRFS into the test chamber in its normal mountine position. The test unit shall be in a deenergized mode during this test.
- B. Raise the internal chamber temperature to 71°C and maintain this condition for a period of 4 hours or more.
- C. At the conclusion of this time period, transfer the unit, within five minutes, to a cold chamber with an internal chamber temperature of -57°C. Maintain for a period of four hours or more.
- D. At the conclusion of this time period, transfer the unit, within five minutes, to a hot chamber with an internal chamber temperature of 71°C. Maintain for a period of four hours or more.
- E. Repeat steps C and D.

- F. Repeat step C.
- G. Return the unit to room ambient temperature until stabilized.
- H. Inspect the unit for damage. Conduct the functional Test detailed in Paragraph 7.0.
- I. With the TRFS mounted in the test chamber raise the temperature to 71°C and allow the unit to stabilize. Apply input voltage and allow one hour warmup time.
- J. Decrease the ambient temperature at a rate of between 2°C and 3°C per minute to -55°C maintain chamber temperature for 30 minutes. Monitor and record baseplate temperature, transient chamber temperature, and frequency offset continuously. Frequency variation shall be less than 3 parts in 1010.
- K. Increase ambient chamber temperature to 71°C at a rate of between 2°C and 3°C per minute. Maintain chamber temperature for 30 minutes. Monitor and record baseplate temperature, transient chamber temperature, and frequency offset continuously. Frequency variation shall be less than 3 parts in 10¹⁰.
- L. Repeat step J.
- M. Repeat step K.
- N. Repeat steps J.
- O. Repeat steps K.

8.3 Random Vibration Test (3.2.5.3.1)

Prerandom Vibration Functional Test

Prior to commencing the random vibration test, the TRFS shall be subjected to the test detailed in Paragraph 7.0

Test Procedure

Perform test in accordance with MIL-STD-810, Test Method 514.2, Procedure IA. Two test levels are required, a perfromance level and an endurance level.

Performance Level Vibration

A. Install the test unit on the vibration fixture and mount the fixture on the vibration table. Vibration shall be applied along each of the three orthogonal axes of the unit while it is in the energized mode.

See Figure 8-1 for axis designation.

- B. Energize the test unit and allow 5 minutes for stabilization.
- C. Subject the test unit to the random vibration levels as shown in Tables 8-1 and 8-2. Random vibration test time shall be 30 minutes per axis. During the first twenty minutes measure phase noise over the range of 1 Hz to 1 KHz from the carrier. For the last 5 minutes monitor output frequency and voltage.
- D. During the vibration exposure along each axis, output frequency error shall be less than 5×10^{-10} . Phase noise limits are as specified in paragraph 6.13. Plot results.
- E. At the completion of each axis vibration exposure, examine the test unit for damage.
- F. Prior to conducting the endurance level vibration, perform the test detailed in Paragraph 7.0.

Endurance Level Vibration

A. Install the test unit on the vibration test fixture and mount the fixture on the vibration table. Vibration shall be applied along each of the three orthogonal axes of the unit while it is in a deenergized mode.

See figure 8-1 for axis designation.

- B. Subject the test unit to the random vibration levels as shoen in Tables 8-3 and 8-4. The endurance level test time shall be two hours per axis.
- C. At the completion of the two hour endurance vibration exposure along each axis, inspect the test unit for damage and perform the test detailed in Paragraph 7.0.

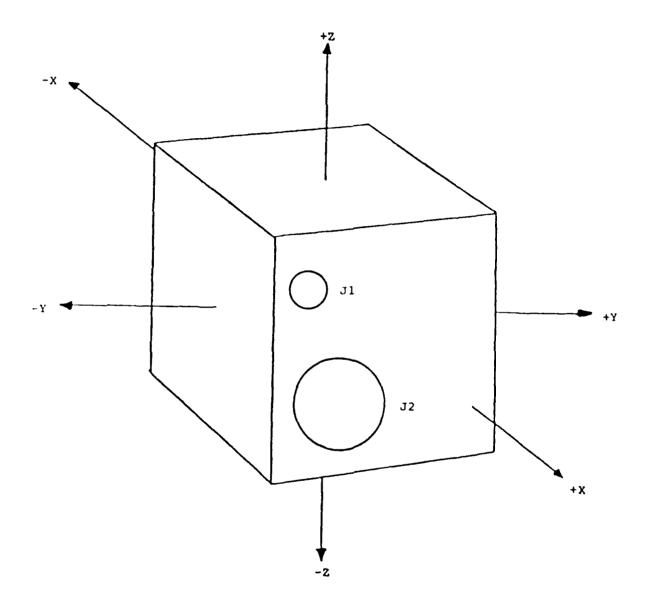


FIGURE 8-1 AXES DESIGNATION

TABLE 8-1. RANDOM PERFORMANCE LEVEL - Z AXIS

Hz	G ² /Hz
15 - 20	0.086
20 - 30	0.332
30 - 40	0.564
40 - 59	0.226
50 - 60	0.037
60 - 70	0.0123
70 - 300	0.01
300 -2000	0.005

NOTE: If unable to test with 0.005 g^2 /Hz then test with 0.01 g^2 /Hz.

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TABLE 8-2. RANDOM PERFORMANCE LEVEL VIBRATION - X & Y AXES

Нz	G ² /Hz
15 - 20	0.223
20 - 30	0.462
30 - 40	0.138
40 - 50	0.133
50 - 60	0.170
60 - 70	0.175
70 - 80	0.136
80 - 90	0.089
90 -100	0.059
100 -110	0.041
110 -120	0.030
120 -130	0.023
130 -140	0.019
140 -150	0.016
150 -160	0.014
160 -170	0.012
170 -180	0.011
180 -300	0.01
300 -2000	0.005

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TABLE 8-3. RANDOM ENDURANCE LEVEL VIBRATION - Z AXIS

Hz	G ² /Hz
15 - 20	0.0857
20 - 30	0.332
30 - 40	0.564
40 - 50	0.226
50 - 60	0.037
60 - 70	0.013
70 - 2000	0.01

8.4 Sinusoidal Vibration Test (3.2.5.3.2a) (3.2.5.3.2b)

Pre-Sinusoidal Vibration Functional Test

Prior to commencing the sinusoidal vibration test, the TRFS shall be subjected to the test detailed in Paragraph 7.0.

Test Procedure.

A. Install the test unit on the vibration test fixture and mount the fixture on the vibration table. Vibration shall be applied along each of the three orthogonal axes of the unit while it is in the energized mode.

See Figure 8-1 for axis designation.

- B. Energize the test unit using input voltage of +28Vdc and 26 Vdc (conditioned).
- C. During the vibration exposure along each axis, output frequency error shall be less than 1 X 10⁻⁹. For frequencies scanned below 20 Hz a gate time of 1 second is used. For frequencies scanned above 20 Hz a gate time of 0.1 second is used. Monitor output frequency and voltage continuously throughout one cycle of the vibration exposure. Measure nonharmonic distortion at the vibration frequencies throughout another cycle.

Record results on data sheet. At the completion of each axis vibration exposure, examine the test unit for damage.

- D. Test in accordance with MIL-STD 810, Test Method 514.2, Producedure VIII, curve W. Subject the test unit to the sinusoidal performance vibration levels as shown in Table 8-5. Frequency cycling shall be from 5 Hz to 500 Hz to 5 Hz in 15 minutes. Frequency cycling shall be 3 hours per axis. Monitor output frequency continuously throughout the vibration exposure.
- E. Test in accordance with MIL-STD 810, method 514.2, Procedure I. Subject the three orthogonal axes of the test unit to the sinusoidal performance vibration cycling and resonant dwells as shown in Tables 8-6, 8-7 and 8-8. Frequency cycling shall be from 5-2000-5 Hz in 20 minutes. Frequency cycling shall be 60 minutes per axis, and resonant dwells shall be 10 minutes at each of the specified frequencies.

B.5 Bench Handling Shock Test (3.2.5.2.1)

Pre-Bench Handling Shock Functional Test.

Prior to commencing the bench handling shock test, the TRFS shall be subjected to the test detailed in Paragraph 7.0.

TABLE 8-4. RANDOM ENDURANCE LEVEL VIBRATION - X & Y AXES

Hz	G ² / Hz
15 - 20	0.223
20 - 30	0.465
30 - 40	0.137
40 - 50	0.088
50 - 60	0.133
60 - 70	0.185
70 - 80	0.171
80 - 90	0.119
90 -100	0.078
100 -110	0.054
110 -120	0.040
120 -130	0.032
130 -140	0.026
140 -150	0.022
150 -160	0.019
160 -170	0.016
170 -180	0.014
180 -190	0.013
190 -200	0.012
200 -2000	0.01

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TABLE 8-5. SINUSOIDAL PERFORMANCE LEVEL VIBRATION - X, Y, & Z AXES

Hz	Input	
5.0 - 5.5	1.0 inch double amplitude	
5.5 - 30	<u>+</u> 1.5 g peak	
30 - 30	0.033 inchés double amplitude	
50 - 500	4.2 g peak	
<u> </u>		

TABLE 8-6. SINUSOIDAL VIBRATION DWELL - X, Y, & Z AXES

Z Axis		Хаг	d Y Axes
Hz	Input Level	Нz	Input Level
35	14.25 g peak	25	6.5 g peak
52	4. 75 g peak	35	6.0 g peak
70	2.0 g peak	50	10.0 g peak
105	1.0 g peak	62	10.5 g peak
		<u> </u>	

TABLE 8-7. SINUSOIDAL PERFORMANCE LEVEL VIBRATION - Z AXIS

Hz	g Peak
5 - 10	1
10 - 20	1.5
20 -22.5	2.5
22.5 - 25	3.75
25 -27.5	5.5
27.5 - 30	8.0
30 -32.5	11.5
32.5 -37.5	14.25
37.5 - 40	13.5
40 -42.5	12
42.5 - 45	9
45 -47.5	7
47.5 - 50	5.5
50 -52.5	4.75
52.5 - 55	4.0
55 ~ 60	3.5
60 - 65	2.75
65 - 70	2.25
70 – 80	2.0
80 - 90	1.5
90 - 100	1.0
100 150	1.0
150 - 500	0.5
500 -2000	0.25

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TABLE 8-8. SINUSOIDAL PERFORMANCE LEVEL VIBRATION - X & Y AXES

	Ηz		g Peak
5	-	10	1
10	-	20	2.5
20	-	22.5	5
22.5	-	27.5	6.5
27.5	-	30	6.0
30	-	35	5.0
35	-	37.5	6.0
37.5		40	7.5
40	-	45	8.25
45	_	50	9.0
50	-	55	10.0
55	-	60	10.5
60	-	65	10.5
65	_	70	10.5
70	-	75	9.5
75	-	80	8.0
80	_	85	7.0
85	_	90	6.0
90	_	95	5.5
95	_	100	4.5
100	_	125	4.0
125	-	150	2.5
150	-	400	2.0
400		1000	1.0
1000		2000	0.5

- Test Procedure

 Perform test in secondance with Hil-STD-810. Test method 516.2.
 Procedure V.

 A. Remove the test unit from its encionare, as if it was being prepared for servicing, and place it on a solid woden banch anomperating mode during test.

 B. To definite sheets limble to occur during service, who one ways of the test unit chessis as a proot are life the opposite edgs of the chassis as a proot are life the opposite edgs of the chassis and been raised & inchessable that the opposite edgs of the chassis has been raised & inchessable that the chassis has been raised been the raised of the chassis has been raised been to the same horizontal face any plots points, for a total of the deep that the raised has been dropped for a total of four times on sech face.

 E. At the conclusion of tests, examine the rest out for any datage that may have occurred during the test.

 8.6 Oppositional Shoot Test [3,2,2,2,2):

 Pre-operational Shoot Test [3,2,2,2,2,2):

 Pre-operational Shoot Test [3,2,2,2,2):

 Pre-operational S

C. At the conclusion of test, examine the test unit for any damage that may have been induced by the shock exposure.

8.7 Acceleration Test (3.2.5.2.3)

Pre-Acceleration Functional Test

Prior to commencing the acceleration test, the TRFS shall be subjected to the test detailed in Paragraph 7.0.

Test Procedure

Perform test in accordance with MIL-STD-810, Test Method 513.2, Procedure II (10 g level).

- A. Mount the test unit on a centrifuge using its normal mounting means and oriented in the direction of forward acceleration.
- B. The location of the test unit (with reference to the glevel established) shall be determined by a measurement from the rotational center of the centrifuge to the geometric center of the test item. Should any point of the test unit nearest the center of the centrifuge experience less than 90 percent of the specified glevel, the test item shall be moved outward on a radius of the centrifuge or the speed of rotation shall be increased until not less than 90 percent of the specified glevel is obtained. The test unit shall be oriented as follows:

Fore: Front or forward end of the unit shall face toward center of centrifuge.

Aft: Reverse unit 180 degrees from the fore position.

Up: Top of unit shall face toward center of centrifuge.

Down: Reverse unit 180 degrees from the position.

Lateral: Each side (right, left) in turn face toward center of centrifuge.

- C. During all of the acceleration tests monitor output frequency and voltage. Frequency error during acceleration force shall be less than 4 x 10^{-11} .
- D. The operating test unit shall be subjected to 10 g acceleration along three mutually perpendicular axes in two opposite directions along each axis. The test duration in each direction shall be 1 minute following centrifuge stabilization. The unit shall be observed for any damage that may have been induced by the acceleration environment during each axis change.

8.8 Acoustic Noise Test (3.2.5.4).

Pre-Acoustic Noise Functional Test.

Prior to commencing the acoustic noise test, the TRFS shall be subjected to the test detailed in Paragraph 7.0.

Test Procedure

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Perform test in accordance with MIL-STD-810, Test Method 515.2, Procedure I, Category A.

- A. The sound pressure profile specified in Figure 8-2, shall be introduced into the test chamber. The average sound pressure distribution (overall level) shall be uniform within -2 to +4 dB of the desired value. The sound pressure field shall be measured without the test unit mounted in the test chamber. Measurements shall be made by using a microphone (more than one if desired) to define the sound field within the test volume (control 10 percent of the chamber volume).
- B. Suspend the test unit in the center of the test chamber by means of springs or elastic cord. The natural frequency of suspension shall be less than 25 Hz. Care must be exercised to insure that no spurious acoustic or vibratory inputs are introduced by the suspension mounting structure. If the test chamber is rectangular, the surfaces of the test unit must not be parallel to the chamber walls.
- C. Mount three microphones in the chamber, each located in proximity to a major dissimilar test unit surface. Each is to be 18 inches or more from the test unit or 1/2 the distance to the nearest wall, whichever is less. The average overall sound pressure distribution around the test unit shall be measured and be uniform within -2 to +4 dB of the desired value.
- During the following test, the unit will be operational. Frequency offset and phase noise are to be recorded throughout the test. During the first twenty minutes measure phase noise over the range of 1 Hz to 1 KHz from the carrier. For the last 5 minutes monitor output frequency and voltage. Allow the unit to stabilize, then record the frequency offset before the acoustic test on the data sheet.
- E. Monitor the three microphones and subject the unit to the overall sound pressure level of 140 dB conforming to the octave band spectrum of Figure 8-2 for a period of 30 minutes or more. The average overall sound pressure distribution around the test unit shall be measured to be uniform within -2 to +4 dB of the specified value.
- F. Record the frequency offset during and after the test on the data sheet. The difference between the offset trifore and the offset during the test shall be less than 5 x 10⁻¹⁰. Thuse noise limits are the same as specified in paragraph 6.13.

OCTAVE BAND FREQUENCY LIMITS (Hz)

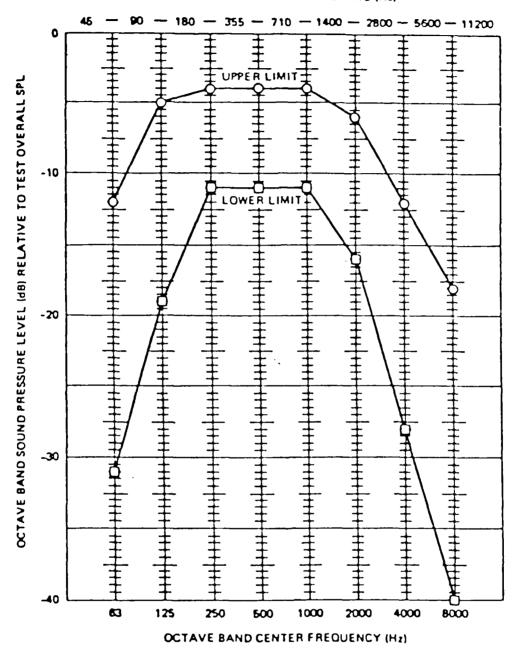


FIGURE 8-2
OCTAVE BAND SPECTRUM FOR THE ACCOUSTIAL NOISE TEST

G. At the conclusion of the acoustic noise test, examine the TRFS for damage.

8.9 Humidity Test (3.2.5.5).

Pre-Humidity Functional Test.

Prior to commencement of the humidity test, the TRFS shall be subjected to the test detailed in Paragraph 7.0.

Test Procedure.

Perform test in accordance with MIL-STD-810, Test Method 507.1, Procedure II. Tests and measurements called out in MIL-STD 810 shall consist of the functional test defined in paragraph 7. Operation of the test unit shall be at the end of each 48 hour cycle.

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8.10 Fungus Test (3.2.5.7).

Fungus test shall be conducted by analysis or in accordance with MIL-STD 810C, Paragraphs 3.1.1 and 3.1.2 respectivley.

8.11 Explosive Atmosphere Test (3.2.5.8).

Pre-Explosive Atmosphere Functional Test.

Prior to commencing the explosive atmosphere test, the TRFS shall be subjected to the test detailed in Paragraph 7.0.

Test Performance.

Perform test in accordance with MIL-STD-810, Test Method 511.1, Procedure I.

A. The test is to be conducted at each of the following simulated altitudes:

Sea Level; 5,000 ft; 10,000 ft; 15,000 ft; 20,000 ft; 30,000 ft; 40,000 ft; 50,000 ft above sea level.

- B. Install the TRFS in the chamber in such a manner that normal electrical operation is possible through the pressure seals from the exterior of the chamber.
- C. Remove or loosen the test unit cover to facilitate the penetration of the explosive mixture.
- D. Seal the test chamber and raise the temperature within to 71 \pm +/- 3°C.
- E. The internal test chamber pressure shall be reduced sufficiently to simulate an altitude approximately 10,000 feet above the desired test altitude. The weight of fuel necessary to produce an air-vapor ratio of 13 to 1 at the desired test altitude shall be admitted to the chamber. A time of 2 to 4 minutes shall be allowed for introduction and

vaporization of the fuel. Air shall be admitted into the chamber until a simulated altitude of 5,000 feet above the test altitude is attained.

- F. Apply 26 +/- 1.3 Vdc power to the unit and allow five minutes warmup time.
- G. If no explosion results, continue to operate the unit and steadily admit air into the chamber until a pressure of 5,000 feet below the test altitude is reached. (Pressurize chamber if necessary to reach sea level pressure when required. Do not test below sea level during sea level test).
- H. If the unit causes an explosion, it has failed the test and no further trials should be attempted.
- I. Turn off unit power. If no explosion has occurred, a sample of the air-vapor mixture is to be ignited by spark-gap or glow plug to verify its potential explosiveness. The sample shall ignite immediately within 3,000 feet of any test altitude below 20,000 feet. For test altitudes of 20,000 feet or higher, ignition at any altitude shall be sufficient evidence to verify that the mixture was ignitable. If the mixture is not explosive, the test is void and the entire procedure must be repeated.

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- J. Repeat steps D through I for each of the altitudes in Para A above.
- K. Upon completing the explosive atmosphere environment, the TRFS shall be examined for evidence or damage induced by the explosive atmosphere exposure.

8.12 Rain Test (3.2.5.10).

Pre-Rain Functional Test.

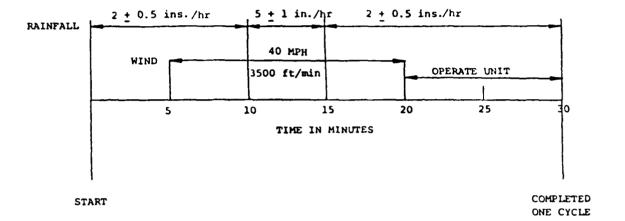
Prior to commencing the rain test, the TRFS shall be subjected to the Test detailed in Paragraph 7.0.

Test Procedure

Perform test in accordance with MIL-STD-810, Test Method 506.1 Procedure I.

- A. Mount the unit to be tested, baseplate down, on an adapter plate and firmly attach using the normal baseplate mounting screws. Securely mount the assembly inside the test chamber in the proper test location such that one side of the unit will be properly exposed to the simulated rainfall. Use waterproof connectors and test cables within the test chamber.
- B. The test item is to be exposed to a simulated rain and wind and operated per the schedule illustrated in Figure 8-3 and described below.

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Each of the sides of the unit, including the top, but not the baseplate side, (5 sides total) shall be exposed to the 30 minute test for a total duration of 2 1/2 hours.

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- C. Produce a simulated falling rain in the test chamber stabilized at a constant rate of 2 +/- 0.5 inches per hour for ten minutes. The rate of rainfall shall then be raised to 5 +/- 1 inches per hour and held at this rate for five minutes. The rate shall then be reduced to 2 +/- 0.5 inches per hour for the next fifteen minutes.
- D. Starting five minutes after the initation of the rain, the wind source shall be turned on and adjusted to produce a horizontal wind velocity of 40 miles per hour (3,500 feet per minute). The wind source shall be maintained at this velocity for fifteen minutes after which the wind source shall be turned off. At this time, apply power to the unit and check the output frequency and voltage level. Operate for 10 minutes for a total test time of 30 minutes. Upon completion of the 30 minutes test, turn unit power off. Turn the unit to expose an untested side of the unit toward the wind source. Repeat the procedures in Paragraphs C and D above for each of the sides of the unit.
- E. Vigually inspect the outside of the unit for damage. Remove the test connectors and the unit cover.

8.13 Salt Fog Test (3.2.5.6).

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Pre-Salt Fog Functional Test.

prior to subjecting the TRFS to salt fog test, perform the test detailed in Paragraph 7.0.

Test Procedure.

Perform test in accordance with MIL-STD-810, Test Method 509.1, Procedure I.

- A. Prepare the test unit for exposure by thoroughly cleaning the outside surfaces of oil, dirt or grease until they are free of water break. Use a non-corrosive solvent that does not leave a film deposit.
- B. Place the unit in the test chamber, baseplate down on an aluminum plate, with all connectors, covers, and inspection plates used in service either in place or adequately covered.
- C. Prepare a 5 percent salt solution (specific gravity 1.027 to 1.041) and ascertain that the pH is in the range 6.5 to 7.2.
- D. Place receptacle for collecting salt fog samples in the chamber, in a central location. Place the receptacle so that it is not shielded by the test unit and so that no drops of solution will be collected from the unit or other sources.

The receptacle is to collect 0.5 to 3 milliliters of solution per hour for each 80 square centimeters of horizontal collecting area (10 cm diameter) based on an average of at least 16 hours.

- E. Expose the unit to the salt fog as specified in the above MIL-STD for a period of 48 hours at a temperature of 35°C.
- F. At the end of the 48 hour exposure period, apply input power to the test unit and perform functional test as detailed in paragraph 7.0. Visually inspect the unit for signs or corrosion or degradation.
- G. Store the test unit in an ambient atmosphere for 48 hours. Reexamine for signs of damage, corrosion, or degradation.
- H. At the end of the 48 hour storage period reaccomplish the tests detailed in Paragraphs 7.0 through 7.3.

8.14 Sand and Dust Test (3.2.5.9)

Pre-Sand and Dust Functional Test.

Prior to commencing the sand and dust test, the TRFS shall be subjected to the test detailed in Paragraph 7.0.

Test Procedure.

Perform test in accordance with MIL-STD-810, Test Method 510.1, Procedure I.

Facility.

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The test facility shall consist of a chamber and accessories to control dust concentration, velocity, temperature, and humidity of dust-laden air, no more than 50 percent of the cross-sectional area (normal to air flow) and 30 percent of the volume of the chamber shall be occupied by the test unit. The chamber shall be provided with a suitable means of maintaining and verifying the dust concentration in circulation. A minimum acceptable means for doing this is by use of a properly calibrated smoke meter and standard light source. The dust-laden cir shall be introduced into the test space in such a manner as to allow it to become approximately laminar in flow before it strikes the test item.

Dust Requirements.

The dust used in this test shall be a fine sand (97-99 percent by weight SiO₂) of angular structure, and shall have the following size distribution as determined by weight, using the U.S. Standard Sieve Series:

- a) 100 percent of this dust shall pass through a 100-mesh screen.
- b) 98 +/- 2 percent of the dust shall pass through a 'n-mesh screen.

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c) 90 +/- 2 percent of the dust shall pass through a 200-mesh screen.

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d) 75 +/- 2 percent of the dust shall pass through a 325-mesh screen.

Note: 140-mesh silica flour as produced by Ottawa Silica Company, Ottawa, Illinois, or equal, is satisfactory for use in the performance of these tests.

Procedure.

- A. Install the test unit in the dust test chamber in a nonoperating condition. Position the unit in the center of the chamber, ensuring a minimum clearance of four inches between surfaces of the unit and any other object or material capable of providing protection. Orient the test unit to expose the front face to the dust stream.
- B. Set the chamber controls to maintain an internal chamber temperature of 23°C (73°F) and a relative humidity of less than 22 percent. Adjust the air velocity to 1,750 +/-250 feet per minute. Adjust the dust feeder to control the dust concentration at 0.3 +/-0.2 grams per cubic foot. Maintain these conditions for 6 hours with the test item non-operating.
- C. Stop the dust feed and reduce the air velocity to 300 +/- 200. Fret per minute. Raise the internal chamber air temperature to 63°C (145°F) and adjust humidity control to maintain a relative humidity of less than 10 percent. Maintain these conditions for 16 hours.
- D. While holding chamber temperature at 63°C (145°F) adjust the air velocity to 1,750 +/+ 250 fpm. Adjust the dust feeder to control the dust concentration at 0.3 +/+ 0.2 grams per cubic foot. Maintain these conditions for 6 hours.
- E. Turn off all chamber controls and allow the test unit to return to standard ambient conditions. Remove accumulated dust from the test unit by brushing, wiping, or shaking, cale being taken to avoid introduction of additional dust into the test unit. Dust shall not be removed by either air blast or vacuum cleaning.
- F. Perform the tests detailed in Paragraph 7.0.
- G. Remove the test unit from the chamber and visually inspect for damage. Examine the connectors internally for dust deposits and evidence of particle penetration.
- H. Remove the cover from the unit and visually inspect the interior and components for dust deposits and evidence of particle penetration. Record all data on the data sheets.

9.0 EMI TESTS (4.2.2.2.5)

The purpose of the EMI tests is to assure that the TRFS complies with all EMI aspects of the equipment specification. This includes the characteristics of the dc power input as stated in paragraphs 3.2.1.10 and 3.3.2.1 as well as the EMI requirements of paragraph 3.3.2.

The following MIL-STD-461B, Class A1 EMI tests shall be performed on the TRFS:

Test			
Method	Test Title		
CEOI	30 Hz to 20 kHz, Power Leads		
CE03	20 kHz to 50 MHz, Power Leads		
CE07	Heater Power Only		
CS 0 1	30 Hz to 50 kHz, Power Leads		
CS02	50 kHz to 400 MHz, Power Leads		
CS06	Spike Susceptibility, Power Leads		
REO2	14 kHz to 10 GHz, Radiated		
	Emission, Electric Field		
RS01	30 Hz to 30 kHz, Magnetic Pield		
RS02	Magnetic Induction Field		
RSO3	14 kHz to 10 GHz Electric Field		

In addition, tests shall be performed to verify compliance with the specified power input transient conditions of MIL-STD-704, Category B and paragraph 3.3.2.1 of Hazeltine Specification 332819, Rev E.

9.1 Test Conditions

Laboratory environmental conditions shall be as follows:

Temperature: 25°C (+15 /-5°C)

Humidity: 90% or less

Baromteric Pressure: Normal ground

Vibration: No appreciable vibration

Primary power, applied to the system under test, shall be maintained in accordance with MIL-STD-704A and the equipment specification.

9.2 Test Procedure

The EMI Tests shall be conducted in accordance with the relevant sections of MIL-STD-461B, MIL-STD-462, MIL-STD-

9.3 Pass/Fail Criteria

The TRFS shall not be damaged or lose lock to its Rb reference under the specified conditions of dc power input and conducted and radiated susceptibility. Nor shall the frequency stability of the unit be impaired so that it would fail to perform its function. A frequency error limit of 1 x 10⁻¹⁰ is consistent with the overall requirements. The pass/fail criteria for conducted and radiated emissions is given in sections of MIL-STD-461B.

10.0 FINAL PERFORMANCE TESTS

Final Performance Tests are conducted to ensure that TRFS performance, after all qualification tests, meets the performance requirements specified in the equipment specification.

Final Performance Tests are a retest of the Performance Tests specified in Paragraphs 6.0 through 6.13. A Long-Term Stability test is also included in Final Performance Tests.

10.1 Long-Term Stability Test (3.2.1.4)

Pre-Long-Term Stability Functional Test

Prior to subjecting the TRFS to the long-term stability test, perform the test detailed in paragraph 7.0.

Test Procedure

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- 'A. Conect unit to test equipment. Apply 26 + 1.3 Vdc input power. Measure and record input voltage on data sheet.
- B. To calculate long term drift, a series of 7 to 30 daily readings must be taken. Determine the daily average fractional frequency offset.
- C. Record the daily readings on graph paper. After a sufficient number of readings have been taken that a trend is evident on the graph, the long term drift may be extrapolated. Record the extrapolated rate of drift.

APPENDIX D

EMI TEST REPORT

REPORT OF

ELECTROMAGNETIC COMPATIBILITY

TEST ON A

RUBIDIUM FREQUENCY STANDARD

(TRFS) S/N 101

FOR

EG&G CORPORATION

TEST PERFORMED BY

SANDERS ASSOCIATES, INC. 95 CANAL STREET NASHUA, NH 03061

P.O. NO. 20575

	DATE	SIGNATURE
TEST INITIATED	3/25/86	*********
TEST COMPLETED	3 19786	*********
REPORT WRITTEN BY	3 30/86	fri B. Vaillmin
TEST TECHNICIAN	10/7/86	Brin S. Vailloum
TEST COORDINATOR	14/7/86	R. Samon
GOVERNMENT REP.		
FINAL RELEASE 5L	1017/86	********

ABSTRACT

Reported in this document are the results of electromagnetic interference (EMI) and electromagnetic compatibility (EMC) testing performed at the Sanders Associates Electromagnetic Compatibility Test Facility, Nashua, NH in August and September, 1986. The item tested was a Rubidium Frequency Standard.

INDEX TERMS: Rubidium Frequency Standard, electromagnetic compatibility.

ELECTROMAGNETIC INTERFERENCE REPORT TEST SUMMARY SHEET

TEST ITE	M: Rubidium Frequency		PORT NO.			COMPL 9	/19/86
	Standard	l				COMPL 9	
MANUFACT				ION: MIL-STD	-461B	Part 4 ((USAF)
	SUMMARY (OF 1		ULTS			
TEST		ĺ	SPEC.			1 :	
METHOD	TITLE	<u></u>	PARA.	REMARKS		PASS	FAIL
CE01	Conducted Emissions, Signal		4.2	ł		X	
	Power Leads, 30 Hz to 15 ki	HZ					: !
CE 03	Conducted Emissions, Signal	, ,	4.3	With shield	له م		Х
CEUJ	Power Leads, 15 kHz to 50	7 3	4.3	power cable			
	MHz	ļ	1	stalled; sh		}	
	1.112	ĺ		not grounde		i .	1
	1			10 uF side.			' I
CE07	Conducted Emissions, Antenn	na l	4.5	i side.		X	! i
0207	Terminal, 10 kHz - 12 GHz		4.5	\			
	1			: 			
CS01	Conducted Susceptibility,	}	4.6	1		x	:
	Power Leads, 30 Hz - 50 kHz	z	, , , , , , , , , , , , , , , , , , ,				
	!	İ		Ì			
CS02	Conducted Susceptibility,		4.7				Х
	Power Leads, 50 kHz - 400	MHz		Ī			İ
				ĺ			:
CS06	Conducted Susceptibility,		4.11			X	!
	Spike, DC Power Leads	[1	f !			
RE02			, , , =	114 - 1 - 1 - 1 - 1		 U	1
REUZ	Radiated Emissions, Electrical Field, 14 kHz - 10 GHz	10	4.15	With shield		X	ļ
	rield, 14 kmz - 10 Gmz			power cable stalled: sh			† Í
				grounded at		}	1
				ends.	boen	1	
RS01	Radiated Susceptibility,		4.17	Cilds.		X	: }
	Magnetic Field, 30 Hz - 50	kHz				**	
]			1		; !	
RS02	Radiated Susceptibility,		4.18	į		X	; l
	Magnetic Induction Fields					ļ	i Į
				ĺ			i
RS03	Radiated Susceptibility,		4.19			X	!
;	'Electric Field, l + kHz -						F 1
	110 GHz					<u> </u>	!

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SUMMARY OF REPORT

Paragraph →.3 CEO3

Narrowband conducted levels at .048 and 10 MHz* on the EUT DC hi leads exceed the CE03 limit by 1.0 and 4.0 dB respectively. See graph 3.

Paragraph -.7 CS02

A frequency error of greater than 1 x 10^{-10} was detected at .+902 MHz during CS02 testing on the system DC hi lead. The threshold of susceptibility was determined to be 0.5 volts rms.

^{*} The conducted level at $10~\mathrm{MHz}$ was reduced $17~\mathrm{dB}$ by installing a shielded power cable (shield not grounded on $10~\mathrm{uF}$ side). This cable did not eliminate the excursion at $.048~\mathrm{MHz}$.

ADMINISTRATIVE DATA

1.0 PURPOSE/REASON FOR TEST

A qualification test to determine compliance of the EG&G Rubidium Frequency Standard S/N 101 to the applicable requirements of MIL-STD-461B Part 4 (USAF) for Class AlC. $^{\circ}$

1.1 DESCRIPTION OF TEST SAMPLE(S)

Submitted for EMI testing was a Rubidium Frequency Standard (TRFS) S/N 101. Power requirements are +26 volts DC.

1.2 DISPOSITION OF TEST SAMPLE(S)

Returned to EG&G via program personnel.

1.3 REFERENCES

MIL-STD-461B (USAF)	Part 4	Electromagnetic Emissions and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-462,	N2	Electromagnetic Interference Characteristics Measurement of
MIL-STD-463		Definitions and Systems of Units Electromag- netic Interference Technology

FACTUAL DATA

2.0 GENERAL

2.1 Accuracy of Measurements

2.1.1 Field Intensity Meters

The principle means of determining frequency and amplitude during the test was one or more of the following field intensity meters:

Model No.	Mfr.	Frequency Range	Frequency Accuracy	Amplitude Accuracy
EMC-10 Calibrated every	Fairchild 6 months	20 Hz-50 kHz	$\pm (1/2\% + 5 \text{ Hz})$	<u>+</u> 1/2 dB
EMC-25 MKIII Calibrated every	Fairchild 6 months	10 kHz-1 GHz	<u>+</u> 2%	<u>+</u> 1.5 dB
8566A Hev	vlett Packard 6 months	100 Hz-22 GHz	<u>+</u> 2 counts	<u>+</u> .2 dB
8568B Hew	vlett Packard 6 months	100 Hz-1.5 GHz	+2 counts	<u>+</u> .2 dB

These instruments were calibrated by the Sanders Associates Instrumentation Calibration/Standards Laboratory, which operates a government approved calibration program in accordance with MIL-C-45662A, "Calibration System Requirements". The calibrating equipment accuracy required by MIL-C-45662A is several orders of magnitude greater than that of the EMC instrumentation listed above. This ensures the greatest possible frequency and amplitude data accuracy.

2.2 Transducers

All antennas—(with one exception)—and current probes use the correction factors supplied by their respective manufacturers. The single exception is the Empire VA-105 41—inch vertical rod antenna (150 kHz to 30 MHz) which is calibrated every twelve months by the Sanders' Calibration Laboratory.

2.3 Signal Sources

A variety of signal sources were used to develop the r.f. environment for system susceptibility tests. The field intensity was monitored by the field intensity meters described above, and so the signal source was not a primary consideration in determining the accuracy of measurement.

The signal sources are calibrated by the S/A Instrument Calibration/ Standards Laboratory on a 12 month cycle.

2.4 Description of Shielded Enclosure

a) Type Construction: Per MIL-E-8881, Type IB per Table I,

Single Shield, Solid Metal, Class C

per Table II

b) Manufacturer: Universal Shielding Corp.

c) Model No.: USC-2034

d) Size: 12' x 32' with 8' x 12' instrumentation

room

e) Door Clearance: 8' wide x 7' high double door

3' x 7' personnel door

f) Filters, Current & USC-50-2X50, 50 amp, 0-400 Hz

Voltage Rating 115V 3 phase

g) Ground Plane Size 32 mil copper and Material:

h) DC Bonding Resistance .2 milliohms

of Ground Plane:

3.0 TEST SAMPLE OPERATION

The Rubidium Frequency Standard (also referred to as EUT*, system, TRFS, unit) was placed on the ground plane 4.0 inches from its leading edge. Bonding of the plate to the ground plane surface was accomplished through the use of C clamps or bolts, while all cabling was given a 2.0 inch non-conductive standoff. Signal/exercise equipment cables were patched into the system via BNC connectors on the enclosure access panel and required +26 volt DC power was applied to the TRFS via filter capacitors, also located on the panel. The EUT was then activated and placed into a normal mode of operation by program personnel.

3.1 Susceptibility Monitoring & Criteria

During testing, the system was monitored to ensure that it remained locked to its Rb reference, and that its frequency stability did not exceed an error of greater than 1 x 10^{-10} . All monitoring was performed by program personnel.

^{*} EUT - Equipment Under Test

TEST METHOD CEOI

CONDUCTED EMISSIONS,

SIGNAL AND POWER LEADS,

30 Hz to 15 kHz

TEST EQUIPMENT

Description	Model/Mfg.	Serial No.	Cal Date	Cal Due
EMI Meter	EMC-11/Fairchild	51 391	8/11/86	10/11/86
Capacitors	10 uF/Sanders	N/A	NCR	NC R
Current Probe	91550-1/Stoddart	BF-496	NCR	NC R

TEST PROCEDURE

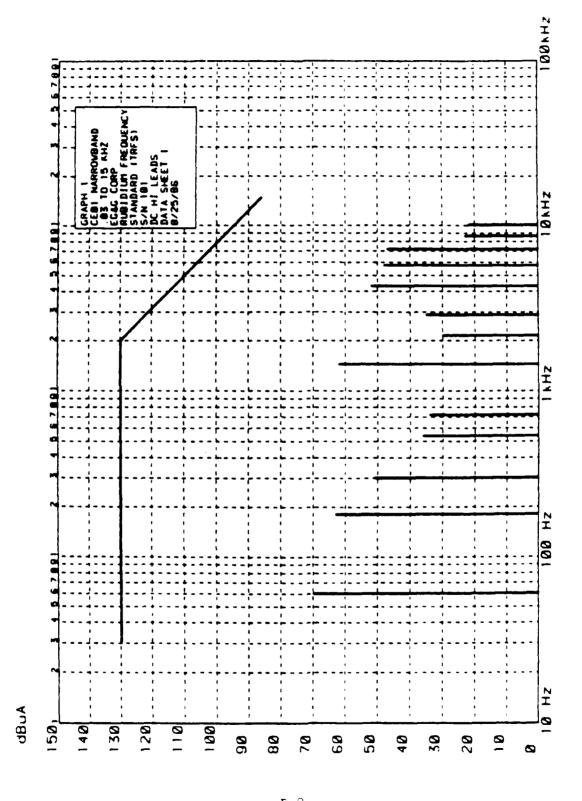
Required +26 volt DC power was applied to the test EUT via the 10 uF fixture. The current probe was clamped around the DC Hi power lead and connected via RG-223 coaxial cable to the EMI meter input, which was activated and calibrated for CEO1 testing. Once the system was activated and placed into a normal mode of operation, the frequency range of 30 Hz to 15 kHz was slowly scanned for evidence of narrowband conducted emissions. Narrowband data is recorded as detected, or at the rate of the three highest peaks per octave. This test was repeated on the DC return lead.

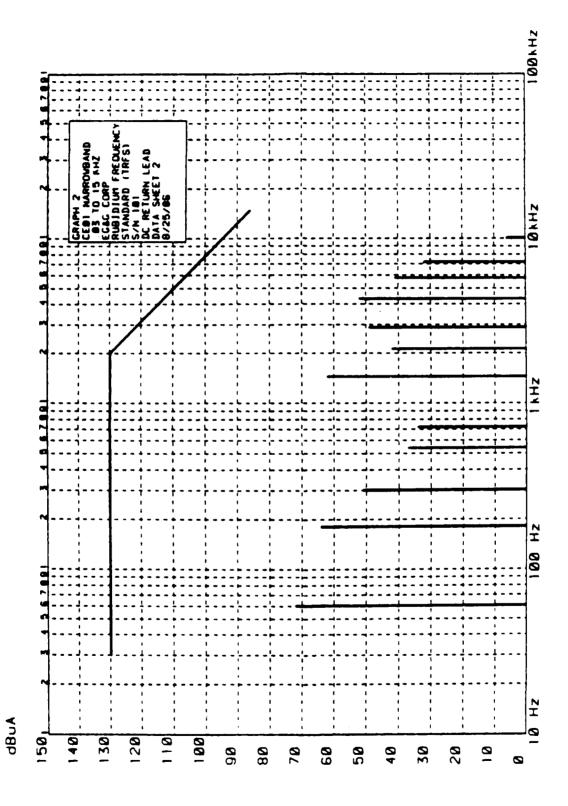
TEST RESULTS

Narrowband conducted emissions comply with the CEO1 limit. See graphs 1 and 2.

CONCLUSIONS

The EG&G Rubidium Frequency Standard S/N 101 complies with Paragraph 4.2 of MIL-STD-461B Part 4 (USAF) for Class AlC equipment.





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ANGESTS OF ASSESSED.

TEST PARAGRAPH -.3

TEST METHOD CEU3

CONDUCTED EMISSIONS,

SIGNAL AND POWER LEADS,

15 kHz to 50 MHz

TEST EQUIPMENT

Description	Model/Mfg.	Serial No.	Cal Date	Cal Due
EMI Meter	EMC-25 MKIII/Fairch	ild 51390	9/3/86	2/3/87
Current Probe	91550-1/Stoddart	BF-496	NCR	NCR
Capacitors	10 uF/Sanders	N/A	NCR	NCR

TEST PROCEDURE

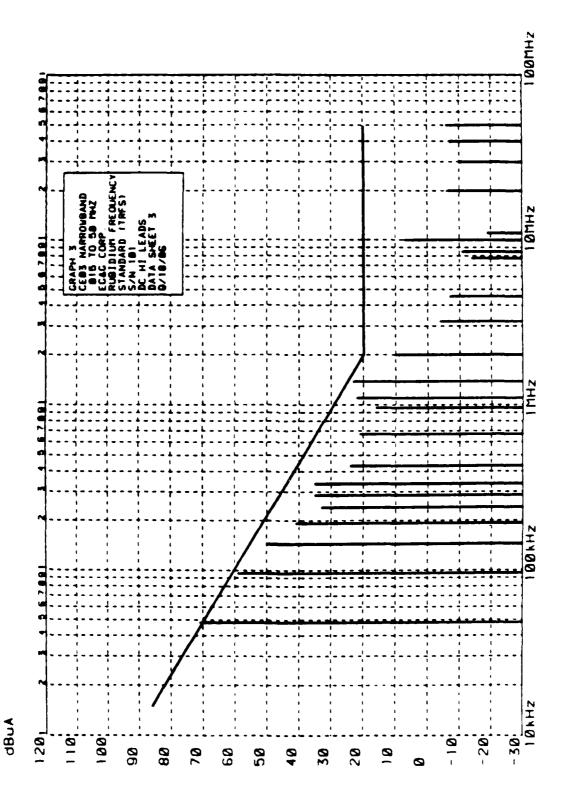
Required power was applied to the TRFS via the 10 uF fixture. The current probe was clamped around the DC Hi power lead and connected via RG-223 coaxial cable to the EMI meter input. Once the EMI meter was activated and calibrated for CEO3 testing, the unit was activated and placed into a normal mode of operation. The frequency range of 15 kHz to 50 MHz was slowly scanned for evidence of narrowband and broadband conducted emissions. Narrowband data is recorded as detected, or at the rate of the three highest peaks per octave as a minimum. Broadband data is recorded at the rate of the three highest peaks per octave. This test was performed on the DC return power lead.

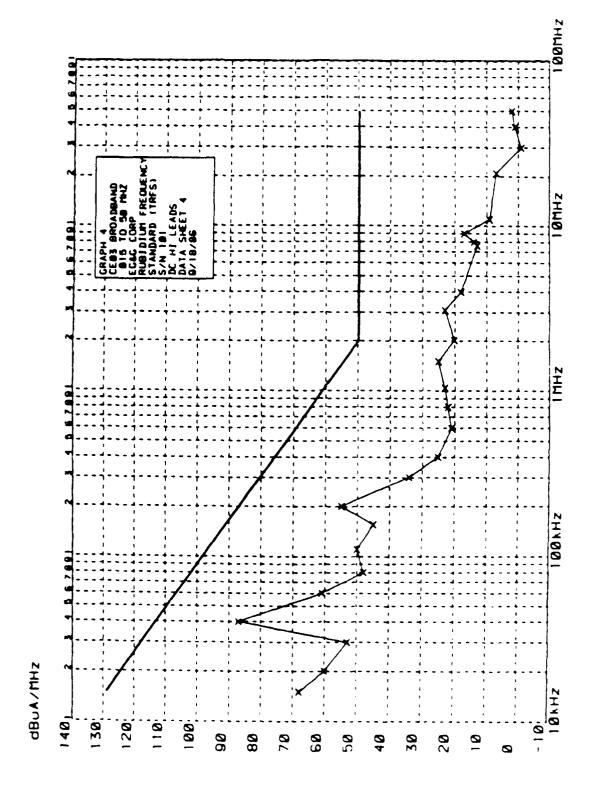
TEST RESULTS

The narrowband conducted level at .048 MHz on the DC Hi power leads exceed the test limit by 1.0 dB. The level at 10 MHz was reduced 17 dB by installing a shielded power cable (shield not grounded at the 1.0 uF fixture), but did nothing to eliminate the 1.0 dB excursion at .048 MHz. See graph 3. Broadband emissions comply with the CEO3 limit. See graph 4. Broadband and narrowband emissions on the unit's DC return lead comply with the test limits. See graphs 5 and 6.

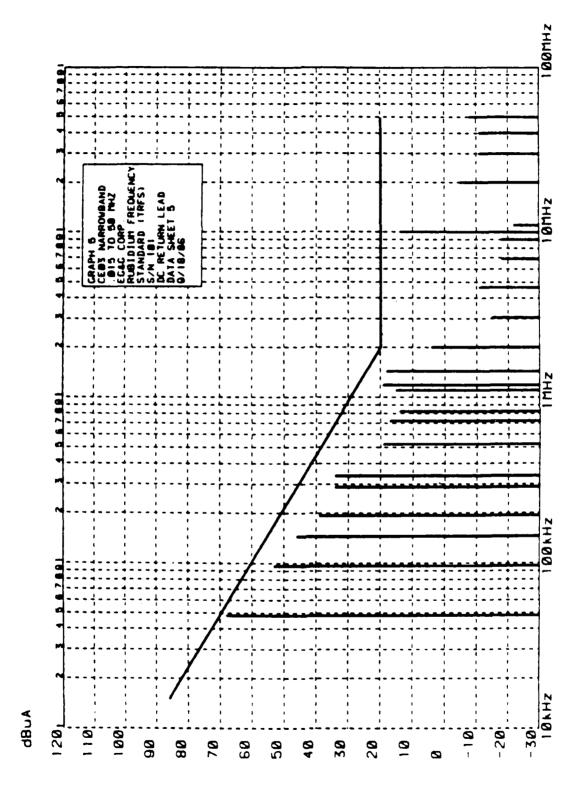
CONCLUSIONS

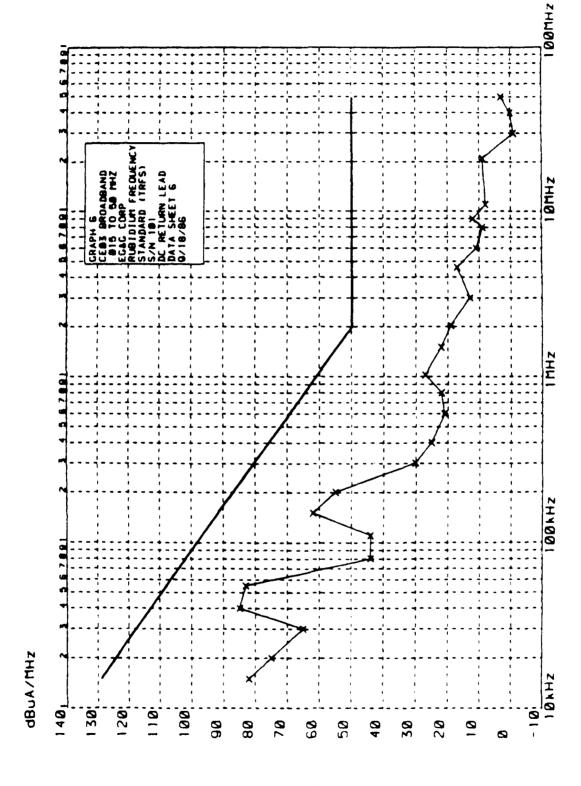
The EG&G Rubidium Frequency Standard S/N 101 does not comply with MIL-STD-461B Part 4 (USAF) for Class AIC equipment.





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TEST METHOD CE07

CONDUCTED EMISSIONS,

SPIKE, TIME DOMAIN

TEST EQUIPMENT

Description	Model/Mfg.	Serial No.	Cal Date	Cal Due
LISN*	91221-1/Stoddart	N/A	NCR	NCR
Oscilloscope	466/Tektronix	16054	9/10/86	3/10/87

TEST PROCEDURE

The 91221-1 LISN was insertd into the +26 volt DC line. Once the oscilloscope was connected to the LISN measuring port, the system was cycled on and off, and the resultant transients photographed.

TEST RESULTS

On and off transients CEO7 limit.

comply with the

CONCLUSIONS

The EG&G Rubidium Frequency Standard S/N 101 complies with Paragraph 4.5 of MIL-STD-461B Part 4 (USAF) for Class AlC equipment.

^{*} LISN - Line Impedance Stabilization Network

TEST METHOD CS01

CONDUCTED SUSCEPTIBILITY,

POWER LEADS,

30 Hz to 50 kHz

TEST EQUIPMENT

Description	Model/Mfg.	Serial No.	Cal Date	Cal Du e
Oscillator	200S/Hewlett Packard	7153	NCR	NC K
Audio Amplifier	6552-lA/Solar	41546	NCR	NCR
RMS Voltmeter	3400A/Hewlett Packard	21043	7/17/86	11/17/
Isolation Transformer	6220-1A/Solar	N/A	NCR	HCR

TEST PROCEDURE

The EUT DC return power lead was placed in series with the isolation transformer secondary winding, while the audio signal source was placed across the primary. Once the rms voltmeter was connected to the transformer terminal marked "AC Voltmeter", the TRFS and test equipment were activated. The requir levels of AC ripple were injected into the return lead while monitoring the un for signs of susceptibility. This test was performed on the DC Hi power lead.

TEST RESULTS

No signs of susceptibility were detected during the course of CSO1 testin on the system DC power input leads.

CONCLUSIONS

The EG&G Rubidium Frequency Standard S/N 101 complies with Paragraph 4.5 of MIL-STD-461B Part 4 (USAF) for Class AlC equipment.

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TEST PARAGRAPH 4.7

TEST METHOD CS02

CONDUCTED SUSCEPTIBILITY,

POWER LEADS,

50 kHz to 400 MHz

TEST EQUIPMENT

Description	Model/Mfg.	Serial No.	Cal Date	Cal Due
Signal Generator	8640B/Hewlett Packard	51 3 92	9/2/86	3/2/87
Signal Generator	606A/Hewlett Packard	1 2969	4/17/86	9/17/86
Amplifier	5100/IFI	38108	NCR	NCR
RF Voltmeter	91CA/Boon ton	2713	8/18/86	11/18/86
Test Fixture	CS02/Sanders	N/A	NCR	NC R

TEST PROCEDURE

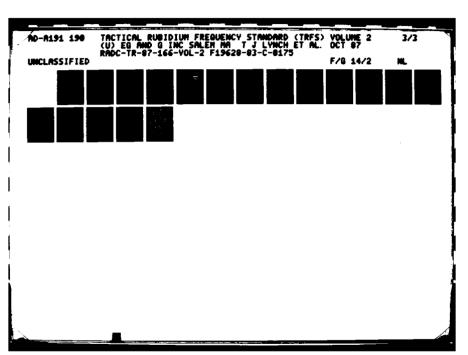
The signal source, RF voltmeter, and TRFS DC Hi power lead were connected to the appropriate terminals on the CSO2 test fixture. Once the system and test equipment were activated, the required 1.0 volt rms was injected into the power lead from 50 kHz to 400 MHz while monitoring for signs of susceptibility. This test was performed on the DC return input power lead.

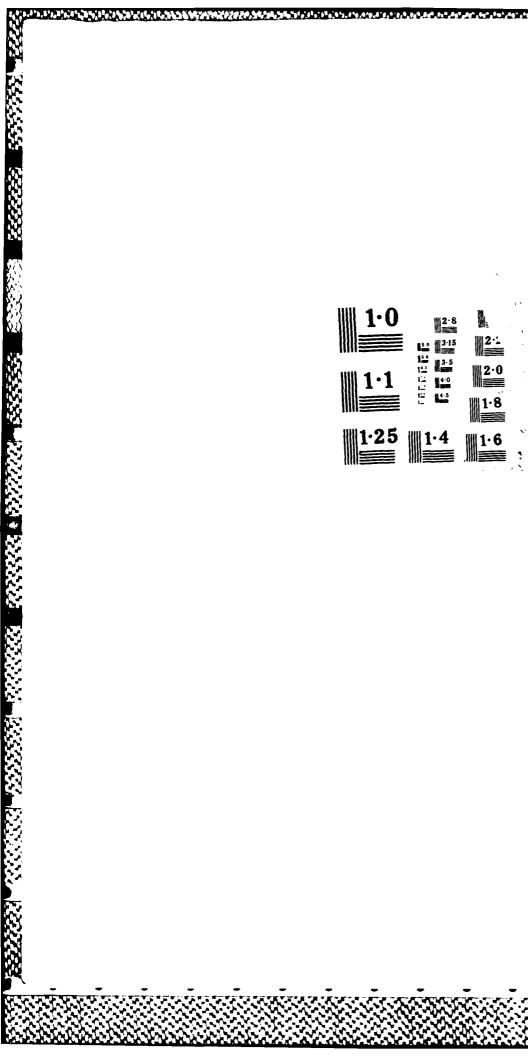
TEST RESULTS

A frequency error of greater than 1×10^{-10} was detected at .4902 MHz while testing the system DC Hi power lead. The threshold of susceptibility was determined to be 0.5 volts rms. No signs of susceptibility were detected while testing the unit DC return lead.

CONCLUSIONS

The EG&G Rubidium Frequency Standard S/N 101 does not comply with Paragraph 4.7 of MIL-STD-461B Part 4 (USAF) for Class AlC equipment.





TEST METHOD CS06

CONDUCTED SUSCEPTIBILITY,

SPIKE,

POWER LEADS

TEST EQUIPMENT

Description	Model/Mfg.	Serial No.	<u>Cal Date</u>	Cal Due
Spike Generator	8282-1/Solar	487 92	NCR	NCR
Inductor	20 uH/Sanders	N/A	NCR	NCR
Oscilloscope	466/Tektronix	39644	11/22/85	11/22/86

TEST PROCEDURE

A 20 uH inductor was placed in series with the TRFS DC Hi power lead. Once the DC output of the spike generator and the oscilloscope input were placed across the unit DC power leads, the test equipment and EUT were activated and given an adequate warm-up period. The required ±200 volt peak, single random and repetitive 0.15 microsecond spikes were injected into the system DC power leads for 5.0 minute time durations each. The TRFS was constantly monitored for signs of susceptibility throughout CS06 testing.

TEST RESULTS

No signs of susceptibility were detected throughout the course of $\ensuremath{\mathsf{CS06}}$ testing.

CONCLUSIONS

The EG&G Rubidium Frequency Standard S/N 101 complies with Paragraph 4.11 of MIL-STD-461B Part 4 (USAF) for Class A1C equipment.

TEST METHOD RE02

RADIATED EMISSIONS,

ELECTRIC FIELD,

14 kHz to 10 GHz

TEST EQUIPMENT

Description	Model/Mfg.	Serial No.	Cal Date	Cal Due
EMI Meter	EMC-25 MK III/Fairchild	51392	9/3/86	2/3/87
Spectrum Analyzer	8566A/Hewlett Packard	42530	9/9/86	3/9/87
Capacitors	10 uF/Sanders	N/A	NCR	NCR
Rod Antenna	RVR-25/Fairchild	512	NCR	NCR
Biconical Antenna	BIA-25/Fairchild	512	NCR	NCR
Log Spiral Antenna	93490-1/Stoddart	10138, 25975	NCR	NCR
Double Ridged Guide Antenna	96001/Ail Tech	2051	NCR	NCR

TEST PROCEDURE

The appropriate EMI meter was activated and calibrated for REO2 testing. Required +26 volt DC power was applied to the TRFS via the 10 uF test fixture. Once the EUT was activated and placed into a normal mode of operation, the appropriate test antenna (see Table 1.0) was placed 1.0 meter from the unit and connected to the EMI meter input. RG-223 coaxial cable was used below 1.0 GHz, hardline thereafter. The frequency range of 14 kHz to 10 GHz was slowly scanned for evidence of narrowband radiated emissions, which are recorded as detected, or at the rate of the three highest frequencies per octave as a minimum. The frequency range of 14 kHz to 1.0 GHz was also scanned for evidence of broadband radiated emissions, which are recorded at the rate of the three highest peaks per octave. Above 25 MHz, linear test antennas were alternately positioned to measure both horizontally and vertically polarized fields.

TEST RESULTS

Broadband radiated emission levels comply with the test limit. See graph 8.

Narrowband levels - especially at 90 and 270 MHz - comply with the REO2 limit with a shielded power cable installed (shield grounded at both ends). See graph 7.

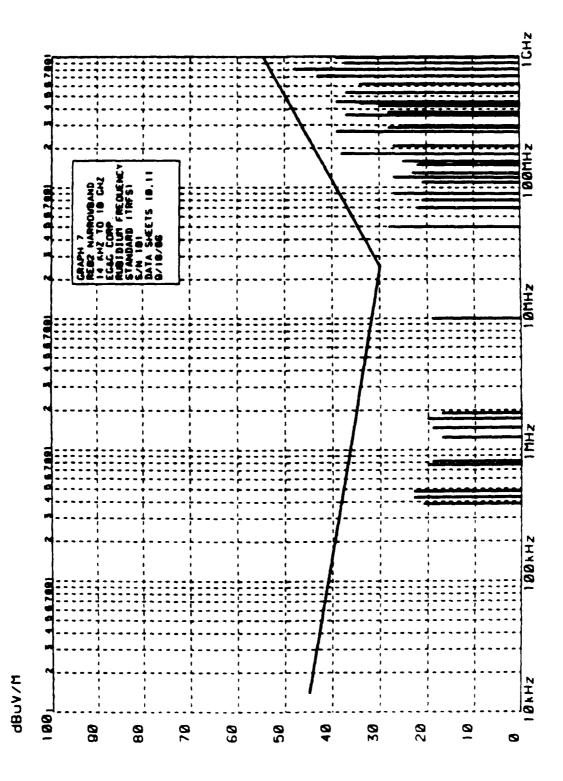
CONCLUSIONS

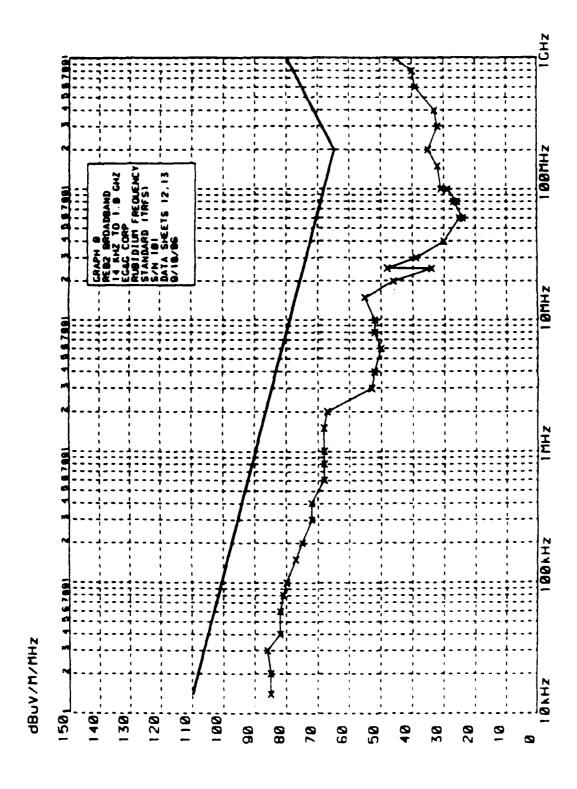
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The EG&G Rubidium Frequency Standard S/N 101 (with shielded power cable installed) complies with Paragraph 4.15 of MIL-STD-461B Part 4 (USAF) for Class AlC equipment.

Frequency Range	Type Antenna
14 kHz to 25 MHz	41 Inch Monopole (with counterpoise)
25 to 200 MHz	Biconical (horizontal and vertical)
200 to 1,000 MHz	Log Spiral
1.0 to 10 GHz	Double Ridged Guide Antenna (horizontal and vertical)

Table 1.0 Antenna Schedule





TEST METHOD RS01

RADIATED SUSCEPTIBILITY,

MAGNETIC FIELD,

30 Hz to 50 kHz

No signs of susceptibility were detected.

TEST PARAGRAPH -.18
TEST METHOD RSD2
RADIATED SUSCEPTIBILITY,
MAGNETIC INDUCTION FIELDS

Paragraphic Control

TEST EQUIPMENT

Description	Model/Mfg.	Serial No.	Cal Date	Cal Due
Variac	W5M/Gen Rad	N/A	NCR	NCR
Isolation Transformer	6220-1A/Solar	N/A	.VCR	NC R
Spike Generator	8282-1/Solar	48792	NCR	NC R
Oscilloscope	466/Tektronix	39644	11/22/85	11/22/86
Ammeter	25A/Simpson	103222	4/9/86	4/9/87

TEST PROCEDURE

A test wire was spiralled around the signal and power leads at the rate of two turns per meter (equally spaced), then taped in place. One turn of this same test wire was also wrapped around the unit case (parallel to the ground plane surface) then taped in place. Note that it was not possible to wrap the unit case with the test wire and keep it at least 15 centimeters from any TRFS connector. In an effort to expedite testing, all test wires (case, signal lead, power leads) were connected in series.

Current Test

The isolation transformer secondary winding was connected in series with the test wire and ammeter, while the variac output was connected across the primary. Once activated, the variac was adjusted to produce 20 amperes of ± 00 Hz current in the test wire for 1.0 minute.

Spike Test

The test wire was connected to the spike generator output. An oscilloscope, also connected across the spike generator output, was used to measure the 200 volt peak transients injected into the test wire at 1.0 and 10 Hz repetition rates for 1.0 minute each.

TEST RESULTS

No signs of susceptibility were detected during RSO2 testing.

CONCLUSIONS

The EG&G Rubidium Frequency Standard S/N 101 complies with Paragraph 4.18 of MIL-STD-461B Part 4 (USAF) for Class AlC equipment.

TEST METHOD RS03

RADIATED SUSCEPTIBILITY,

ELECTRIC FIELD

14 kHz to 10 GHz

TEST EQUIPMENT

Description	Model/Mfg.	Serial No.	Cal Date	Cal Due
Display Section	141T/Hewlett Packard	40033	3/3/86	3/3/87
IF Section	8552A/Hewlett Packard	35233	4/9/86	4/9/87
RF Section	8555A/Hewlett Packard	40033-3	3/26/86	3/26/87
Field Intensity Meter	EFS-1/IFI	36629	1/8/86	1/8/87
Oscillator	200S/Hewlett Packard	7153	NCR	NC R
Signal Generator	8640B/Hewlett Packard	51 3 92	9/2/86	3/2/87
Signal Generator	606A/Hewlett Packard	23764	6/18/86	11/18/86
Signal Generator	614A/Hewlett Packard	1677	12/31/85	9/30/86
Signal Generator	616B/Hewlett Packard	6080	4/15/86	1/15/87
Signal Generator	8683D/Hewlett Packard	57809	8/11/86	2/11/87
Wideband Amplifier	5100/IFI	38108	NCR	NCR
Broadband Power Amp.	35512/AIL Tech	41788	NCR	NCR
TWT Amplifier	1277HL/Hughes	38385	NCR	NC R
TWT Amplifier	8020H/Hughes	53257,53258	NCR	NCR
TWT Amplifier	1277HX/Hughes	36879	NCR	NCR
Power Rod Antenna	41"/Sanders	N/A	NCR	NC R
Power Biconical Antenna	RS03/Sanders	N/A	NCR	NCR
Log Spiral Antennas	93490-1/Stoddart	10138, 25975	NCR	NCR
Double Ridged Guide 'ntennas	96001/AIL Tech	2051, 2086	NCR	NCR
Attenuator	768-20/Narda	7519	4/27/86	4/27/88
Amplifier	15100B/Eaton	44182	NCR	NCR

TEST PROCEDURE

The appropriate transmit antenna (see Table 2.0) was placed 1.0 meter from the TRFS chassis and connected to the signal source. A field intensity meter, placed in the same geometry as the TRFS, was used to monitor the fields from 14 kHz to 200 MHz, While the field calibration antenna technique was used thereafter. Once the equipment and EUT were activated and allowed an adequate warm-up, the system was immersed in the required electric fields from 14 kHz to 10 GHz (see Table 3.0). During testing, the TRFS was constantly monitored for signs of susceptibility.

Frequency Range	Type Antenna
14 kHz to 25 MHz	41" Monopole (with counterpoise)
25 to 200 MHz	Biconical (horizontal and vertical)
200 to 1,000 MHz	Log Spiral
1.0 to 10 GHz	Double Ridged Guide (horizontal and vertical)

Table 2.0 Antenna Schedule

Frequency Range	Electric Field
14 kHz to 30 MHz	10 Volts/meter
30 to 10 GHz	5 Volts/meter

Table 3.0 Required Electric Fields

TEST RESULTS

No signs of susceptibility were detected during RSO3 testing.

CONCLUSIONS

The EG&G Rubidium Frequency Standard S/N 101 complies with Paragraph 4.19 of MIL-STD-461B Part 4 (USAF) for Class AlC equipment.

APPENDIX E

FREQUENCY MEASURING SYSTEM

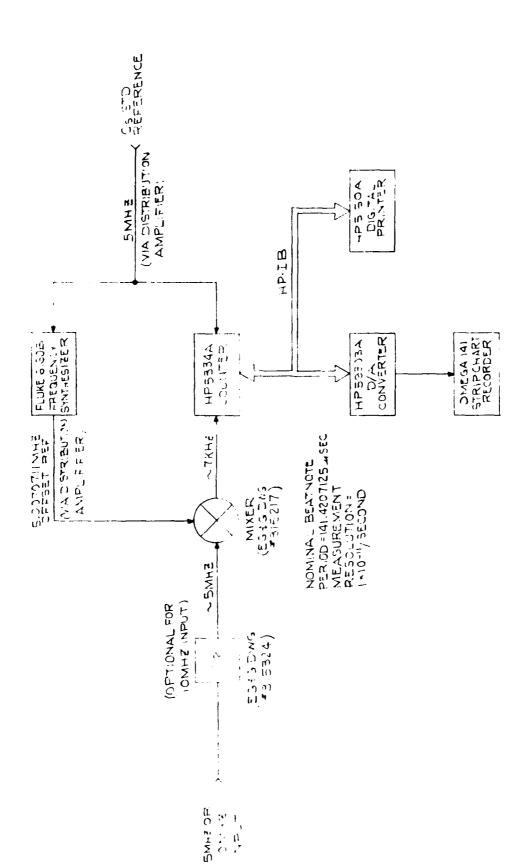


Figure E-1. Frequency Measuring System Block Diagram.

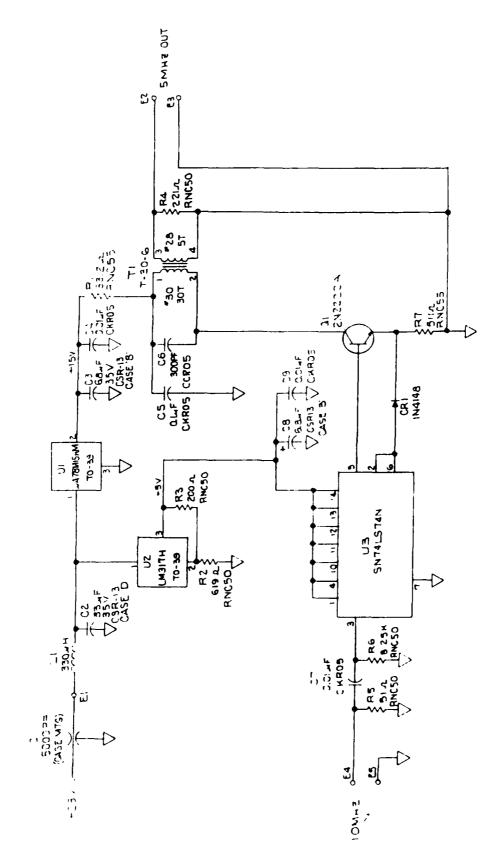
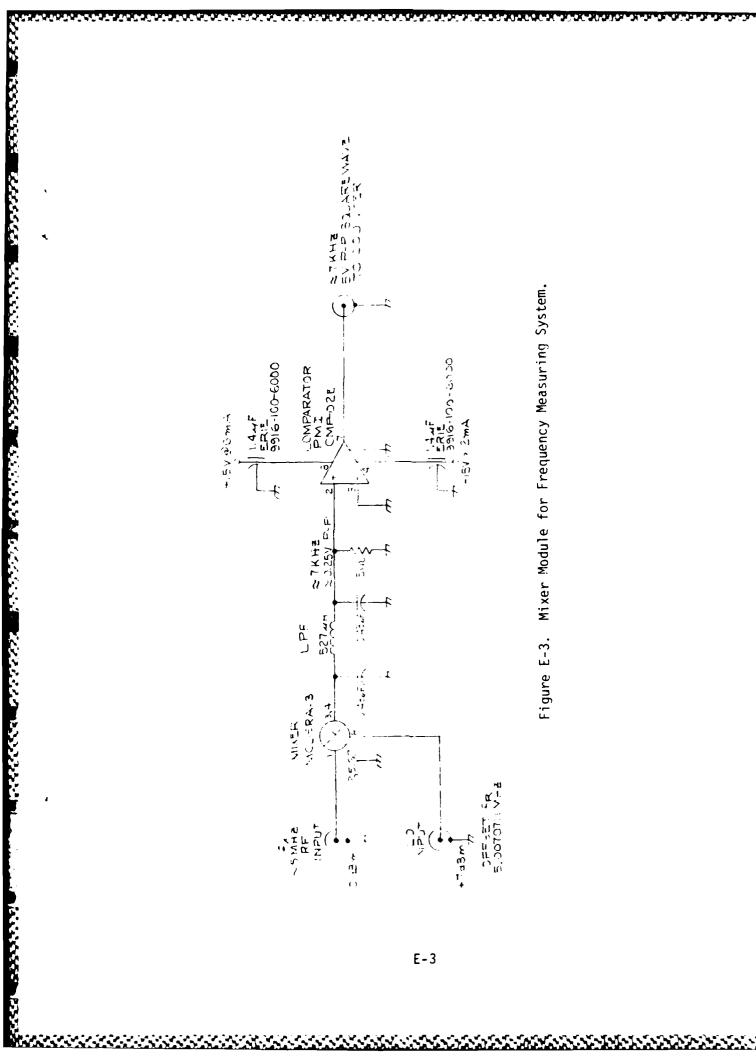


Figure E-2. 10 MHz Frequency Divider Measuring System Schematic.



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